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"The Viking Age."

THE main point which is sought to be established in the remarkable book* which Mr. Du Chaillu has brought out under the above title is suggested in the sub-title — "The Early History, Manners, and Customs of the Ancestors of the English-speaking Nations." We have been accustomed to think of the Vikings or Norsemen as a piratical horde who harassed the shores of Britain and Northern Europe, settling where they could find foothold, and with whom we modern English have a partial relationship through early admixture of Saxon with Norse blood. Mr. Du Chaillu's position is that the Norsemen were the great dominant race of Northern Europe for some time previous to the Roman conquest of Gaul and Britain; that the Saxons themselves were a portion of the Norse race, and not a local and opposing race; and further, that the Norse or Vikings had their original cradle on the shores of the Black Sea; that they had close connexion with Greece and Egypt in art and civilisation, and worked their way Northward across Europe; and that the English-speaking race generally are the direct descendants of this sea-loving and invading people; that we are far less mixed in race, far more purely Norse, than has been hitherto admitted.

Among the reasons given by the author in his opening chapter for this subversive theory the following may be shortly summed up. There is evidence both in the pictures of life given in the Sagas and Eddas, and in the numerous archæological remains of Norway and Sweden, that the people of the North, even before the time when they carried their warfare into Gaul and Britain, were possessed of a high degree of civilisation, consequently that they had been a great and powerful nation for a long time, as nations do not start up at once fully equipped with arts and civilisation. As to one portion of this argument we may say at once that the long and multifarious translations from the Sagas and Eddas with which Mr. du Chaillu's book is filled do not convey any such idea to us; they rather represent the simplicity and childish faith of a half-civilised people. The art is another matter. "The weapons found with their peculiar Northern ornamentation, and the serpent-ring coats of mail, show the skill of the people in working iron. A great number of their early swords and other weapons are damascened even so far back as the beginning of the Christian and era, show either that his art was practised in the North long before its introduction into the rest of Europe from Damascus by the Crusaders, or that the Norsemen were so far advanced as to appreciate the artistic manufactures of Southern nations." Stress is laid also upon the fact (not to be denied) that many objects of Northern art show a strong affinity with Greek, Etruscan, and Roman forms. But the conclusion from this cannot in these days be pushed very far, at least in the direction in which the author wishes to push it. Many forms once supposed to be characteristic of Early Greek ornament have been found in Mexico; and, in fact, the further research goes in regard to early ornament, the more we are led to think that many early forms of ornament may be expected to be found in any quarter of the globe. There is more importance in the argument derived from the evidently advanced and powerful state of the navy of the Viking nation or nations. Mr. Du Chaillu quotes Tacitus as referring in the first century A.D. to the northern nation of the "Sueones," who were strong in ships, and ships described as having a prow at each end, and therefore corresponding to the typical form seen in the remains of Viking vessels. The author says "it stands to reason that the maritime power of the Sueones must have been the growth of centuries before the time of Tacitus, and from analogy of historical records we know that the fleets of powerful nations do not remain idle. Hence we must come to the conclusion that the Sueones navigated the sea long before the time of Tacitus." This of course is a rational conclusion, involving also the idea of an important nation with an independent existence extending some time back. Then the author alludes to the fact that Roman writers later than Tacitus make mention of maritime expeditions by the Saxons and Franks, and the same argument is applied, that the maritime power of these people referred to could not have arisen suddenly, nor could that of the Sueones have disappeared suddenly, though they cease to be mentioned by Roman writers. Hence the conclusion that the Franks and Saxons of later Roman writers, alluded to as a race powerful in their equipment for naval warfare, were only the Sueones under other names. If not, what had become of the formidable Sueones after the days of Tacitus?

The argument of course only holds good on the supposition that the maritime nation referred to was one of great power and extent. A mere marauding tribe, however brilliant its achievements for a time, might soon die out or disperse and give place to another carrying on a somewhat similar existence. In fact, the author's argument so far rather approaches to arguing in a circle. The northern maritime nation mentioned by the Romans must have been a great and important people to have had the navy they evidently had, and to have been spoken of with so much respect by the Romans. This first nation, A, being such a powerful nation, could not have disappeared suddenly, and therefore when the Romans spoke of another powerful maritime nation, B, in the next century, they must have really referred to A. And A and B being the same nation under two different names, must have filled a great place in early European history, and must be the real parents of the whole English-speaking race. That is pretty much the way the argument stands, and it is a loose one enough. When we come to consider the immense extent and the frequent richness and beauty of the remains of northern art work we get a firmer and more logical ground on which to rest a conviction that the people who left all this behind them were a good deal more than a tribe of sea-pirates. It is only of late years that we have realised how rich and interesting are the remains of Norse ornament and art workmanship, and how fine was the design and construction of their ships: and this is, as far as it goes, a fact in favour of Mr. Du Chaillu's theory which cannot be ignored. As to the similarity between Norse and Greek forms in some examples, we have already observed that the argument from similarities of this kind cannot be pushed very far,—certainly it can hardly justify the author in putting forth a map of Europe as the land of the Viking, with the names of the principal countries spelt so as to suggest their "Viking" origin,—"Grikland," "Tyrkland," "Spänn," &c.; or for

* The Viking Age: The Early History, Manners, and Customs of the Ancestors of the English-speaking Nations. Illustrated from the antiquities discovered in mounds, cairns, and bogs, as well as from the ancient Sagas and Eddas. By Paul B. Du Chaillu. With 1,366 illustrations and map. London: John Murray; 1889.

placing the more or less mythical city of Asgard on a bend of the Dnieper. This is obviously trying to prove too much; and it is a pity the author should have added to his book a map which he himself can hardly, in his inmost conviction, have expected his readers to take seriously.

The real value of the work, from our point of view, is not so much in its historical theory (which it is not our special business to consider, but which we should think open to somewhat more than doubt,) as in the unusually voluminous collection it includes of illustrations of ancient Norse art. The general conclusion to be derived from these illustrations is in itself, we must observe, adverse to the theory that the English are more directly and specially the descendants of the Vikings than has been usually supposed, or that the so-called Saxon element in our descent is really a Viking element. As a general rule national character is very decidedly shown in the style and taste of decorative work, and peculiarities in this class of work are very distinctly traceable in the same people from one generation to another. Now the mass of Norse design illustrated here is not in harmony with what we have been accustomed to regard as the characteristics of English mediæval art. They have a *cachet* of their own which is not English; and therefore so far they are adverse to the theory that Anglo-Saxon and Norman are one race, and that the English are its lineal representatives; and the portion of the book which constitutes its chief interest seems in opposition to what the author would have made his main point.

This is how the matter appears to us, though we admit that to form a settled and logical conviction in regard to the historical views propounded would demand long and careful examination, and that further light on the subject may show that there is more basis for Mr. Du Chaillu's opinions than appears probable at first sight, though we do not think that his South European cradle for the Viking will be likely to be ultimately accepted. But his book has brought in a popular form before English readers the characteristics of ancient Norse art by a multitude of engravings which give it a high illustrative value.

There runs through all the sets of illustrations the attempt to connect them with similar forms found elsewhere, though the deduction to be drawn from these resemblances is not always or necessarily that which the author would draw. There does seem however to be sufficient to justify an idea that early Norsemen had wider connexions through commerce than has been realised. The author gives one illustration, in the chapter on "bronze weapons" of a curious form of one-edged sword or scimitar, with the point curled round into a scroll. He notes that "Professor Stephens in his 'Runic Monuments' shows that this type is Assyrian, and that it has come by the trade route through Russia into Sweden from Asia." There is a note in the chapter on "the graves of the earlier Iron Age" as to the finding of objects of Roman manufacture in these graves, but the statement is rather vaguely put and does not appear to be directly borne out in any of the objects illustrated. The most interesting and characteristic articles illustrated in the chapter on bronze weapons are the axes, of which we illustrate, by the permission of the publisher, one of the most artistic examples in point of design (fig. 1); this exceedingly business-like type of narrow axe-head, thick in the upper part and thinning down into a sharp wedge, is shown in a good many forms, nearly all of them exhibiting a good deal of character and force of design in a simple manner: and they are certainly thoroughly well made for their purpose. The spiral bracelet of gold (fig. 2), one of the illustrations to the chapter on "The Dress of Women" in the second volume, is interesting for an opposite reason; the axe-head just referred to is peculiar in type and characteristically Northern; the bracelet, an admirable bit of simple design, might have been Roman work; but the value and the ductile quality of gold have led to its being treated in a very similar manner among people very far apart. In fact, it might almost be said that in the period before and about the Christian era there was only one treatment for gold all over the world, for the same characteristics seem to be apparent wherever we find the metal used for personal ornaments; the use to which it has been most largely put in the world's history. The two clay urns shown in fig. 3, discovered in the Kannikegaard Cemetery, are taken from a great number of examples given in the chapter on "Urns of Clay;" some of the shapes are curious, but for the most part these again illustrate the fact that there is over all the world, in early dates, a certain degree of family likeness in potters' work of this kind; in reference to which we may subjoin a sketch which has been sent us (fig. 5) of a small earthen vase recently dug up at Ardgour in Argyllshire, and bearing a simple incised ornament as indicated. The shape of this is very similar to that of some in the chapter before us. The one we have numbered here as fig. 3 we selected as an interesting specimen of simple but effective design formed by the receding faces at the neck, the double series of handles alternating, and the parallel lining on two of the faces. Fig. 4 is curious as an example of a remarkably classic-looking form (also found at Kannikegaard); but there is a bronze Japanese vase of very similar shape in the South Kensington Museum. The glass vessel illustrated as fig. 6, however, found in a round tumulus in Norway (precise place not stated), is a really curious example to have come from that latitude, and has a singularly classic look about it, as indeed is the case with other objects illustrated in the chapter on glass vessels. The author asserts that "many of them are evidently of Greek some perhaps of Roman origin"; but it is not clear whether he means to imply that the designs are of Greek type, or that the actual objects were of Greek or Roman manufacture. The latter we should think very doubtful. It is with glass as with gold: it is a peculiar substance lending itself most readily to certain special forms of treatment, especially in its ductile state when heated; and it is not surprising if the same conditions should lead to somewhat similar methods of treatment even among two people who had no direct connexion with each other.

Reference has been made to the use by the Vikings of the process subsequently called Damascening, of which we presume the author intends the scabbard ferrules, of which one is shown as fig. 7, to be taken as examples. These are iron, inlaid with flat hammered gold wire. This is from a class of objects found largely in bogs, and classified by the author as "bog finds." These appear to be all on sites near the sea, and are stated to have

ig. 1.—Bronze Axe: half real size.

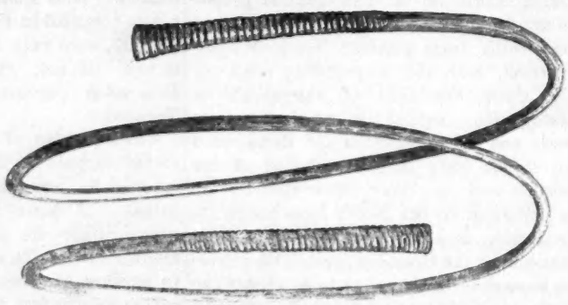


Fig. 2.—Spiral Bracelet of gold; real size. Found in a stone cairn.

Fig. 3.—Clay Urn; one-eighth real size.

Fig. 4.—Clay Urn.

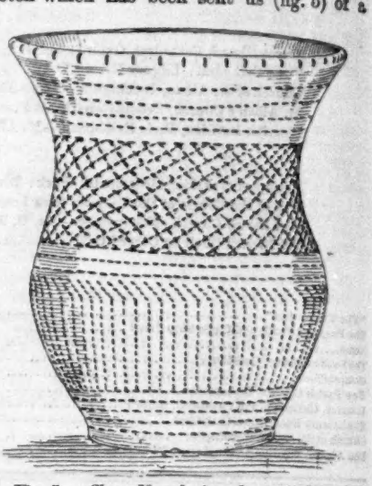


Fig. 5.—Clay Vessel, found at Ardgour, Argyllshire.

Fig. 6.—Glass Cup; one-quarter real size. Found in a round tumulus.

Fig. 9.—*Buckle of a Belt in silver and bronze, ornamented with garnets; real size.*

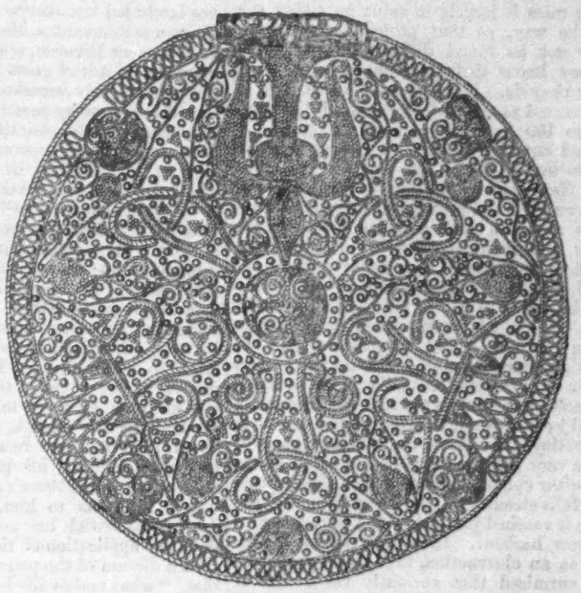


Fig. 10.—*Bracteate of gold; real size. Tuft Church, Sandwich.*

yielded a certain number of Roman coins and other objects. We cannot help feeling, however, that the author is under rather a temptation to attach a Roman origin to things

Fig. 7.—*Iron Ferrule to Scabbard, inlaid with gold wire.*

which appear to afford any excuse for it, and which can thus support the theory as to the relations, either in peace or in warfare, between the Norsemen and the Romans. The fragment of chain armour shown as fig. 8, also a "bog find," is certainly Northern

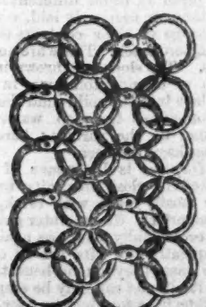


Fig. 8.—*Fragment of Chain Armour; real size.*

enough in character, and indicates a very fine and elaborate piece of work, with each ring formed of a small serpent; the illustration is the real size. The buckle in silver and bronze (fig. 9), belonging to what we are told is "the earlier iron age," is a very forcible and characteristic piece of Northern workmanship: so also is the fine and elaborate piece of gold work, real size, shown as fig. 10, and which is an example of a class of ornaments which the author terms "bracteates," a term the meaning and origin of which he does not define; the etymology of the name would imply that these were to be worn on the arm, but what is stated is that they were worn round the neck, and were possibly protective amulets. "They are formed by embossing or stamping upon a disc, and the gold is extremely thin." Some of them have devices on them to which some meaning was evidently attached; this is obvious in some of the examples illustrated, but not, we think in this one, which appears to be purely ornamental work of a very charming type.

The few illustrations we have reproduced, selected mainly because they illustrated one or other of the points we wished to touch upon, must not be taken as giving any idea of the wealth of illustration in the book, which in this respect has a value quite independent of the historic theory which underlies it, and the artistic reader may accept or reject this as he pleases without any prejudice to the interest which he will certainly derive from so rich and compendious a book of illustration of the characteristics of Norse design.

THE PROPOSED FORTH AND CLYDE SHIP CANAL.

THIS scheme, instead of making practical progress, as was expected, has passed for a time into a condition of mere controversy on the question of route. There has been undue haste at the last, and crude estimates of cost have been made up and published on no other survey than that afforded by the Ordnance map. An Edinburgh firm of engineers, thus pressing the pace, want the canal carried round by Loch Long, a chief arm of the Clyde estuary, over a track fully fifty miles in length by way of the Forth Valley and Loch Lomond, and involving the cutting of mast-high tunnels through two intervening ridges. At the same time they profess to have looked critically into the natural crossing between the Forth at Grangemouth and the Clyde at Glasgow, *vid* Falkirk, Kilsyth, and Kirkintilloch, and to have found in it many drawbacks. In the main the Loch Lomond proposal has, in the North, been met with something very like derision, and the opinion is frequently hazarded that if the scheme is confined solely to this mode of solution it never will be carried into effect at all; but the objections taken to the central route have been receiving serious consideration, and it is on these that the discussion now turns. Those of them dealing with the amount of excavation necessary can only be decided by the results of a competent engineering survey of the track, and there is every probability that this will be obtained; but others are on the surface, and may be answered without waiting. A chief objection, singular to say, consists in the presence of the already-deepened Clyde along part of the proposed central route from firth to firth, but most people will rather be disposed to regard this as a foremost inducement, and, further, to perceive no great matter of ultimate difficulty in the reconcilement of the two interests of canal and river for purposes of harmonious working. The Clyde is Glasgow's peculiar property, and Glasgow, as a port, must recognise the enormous advantages to it of a direct passage to the eastern sea, and is, no doubt, prepared to purchase these by abundant facilities and every reasonable concession. It is assumed in this table of drawbacks that the sea-to-sea waterway must offer free passage at all times of the tide to ships of the highest class and to war-vessels; but this is, perhaps, straining after too high a standard to begin with. A ship canal, capable of passing at stated daily tidal periods such vessels as the Clyde at present accommodates up to Glasgow Harbour under similar conditions, would certainly be an important acquisition, and even a brilliant achievement as a beginning. All but the deepest-laden craft might thus pass, by choosing fitting time and opportunity. Some of our natural sea channels are frequented by the largest class of vessels; the Pentland Firth, for instance, affords safe passage only at intervals of tide and wind, and navigators do not regard it as much of a hindrance to study these. It is also assumed that the land along

the central valley, being of high value, would be very costly to purchase, but, in point of fact, the land at present is only of very poor value, slightly built upon, and part of it morass. The making of a ship-canal would, probably, enhance the value of this unproductive tract tenfold at some points, and certainly raise it largely in value on either side all the way, so that proprietors will probably not be found difficult to deal with, if they know their own interests, as most likely they do. For some miles the canal (if constructed as a tidal work) would be sunk 100 to 150 ft. in its cutting, and this, it is pointed out, would be most inconvenient for public works, &c., on the banks. The Tyne from Newcastle to the sea is similarly sunk between high and precipitous banks, but these banks are clad and crowded with marine works and manufactories to an extent unmatched, perhaps, in any other part of the world, and this objection, also, may therefore be taken as not of very serious account. Even the much-commended straightness of the route is called in question, and the fact significantly pointed out that the river Kelvin over the last few miles of its course is tortuous; but there is no real significance in this objection, for at the elbow where the river and valley thus leave the straight there is only a very narrow ridge of quite low elevation, after cutting through which the surface-level falls steadily on the direct line, till the Clyde is reached just below the boundaries of Glasgow harbour. Indeed, so trifling is this ridge as an obstruction, that some geologists have surmised that anciently the course of the Kelvin was not deflected here, but held straight on to the Clyde, and was two or three miles shorter than now. It will be seen that at least a few of the exceptions thus taken to the direct central crossing are very trifling in character, betokening, perhaps, no more than the existence of a perhaps unconscious prejudice, coupled with an anxiety to marshal every possible feature likely in the smallest degree to tell unfavourably. Another objection advanced is in regard to the cost of excavation, which it is alleged will be so heavy as to preclude all chances of the canal paying as a commercial and financial undertaking. This, however, is a mere assertion unsupported as yet by ascertained knowledge; and in the absence of adequate surveys, the same must be said of the alleged financial feasibility of the roundabout Forth Valley and Loch Lomond route. If the natural surface depression, stretching between Grangemouth and Glasgow, although low, be still not low enough to permit of the construction of a canal, except at a lasting loss to the original investors, it would be better not to begin the work at all; but this cannot be decided in any off-hand manner, or in any way except by a careful survey in the hands of engineers who enter on their work with perfectly open mind, that is to say without prejudice either for or against. Such a survey, it is to be hoped, the committee now being formed in Glasgow will be able to procure, and till then the controversy may as well rest. One feature there is which neither the advocates nor the opponents of the "direct" scheme have touched, and that is the striking facilities of the valley as it stands for the carrying on of an undertaking involving the bringing to bear of ponderous engineering plant and the removal of a mountain of *débris*. The existing Forth and Clyde Canal, which no doubt would have to be bought up by the new Company, could be utilised unquestionably with most important economical results; and there is a railway also from end to end, which at present is not overburdened with traffic. Forces of men and material could be concentrated here at a fraction of the initial costs attaching to remote works like the Panama Canal or the Nicaragua undertaking, and there would likewise be a liberal choice of landing and shipping ports within easy reach at either extremity. Granting other things equal, there is no other crossing in Scotland in the least to be compared with it in respect of the constructive advantages named.

NOTES.

"USE your property so that it does not injure your neighbour" is one of those apparently plain and simple maxims of law and conduct which over and over again lead judges and less able men very much astray. We believe this maxim has lately led Mr. Justice Kekewich wrong in the case of Reinhardt *v.* Mentasti (Law Reports 42, Chancery Division, p. 685). As the judgment stands it is of great importance, and, as the judge rightly remarked, "may affect many localities and many persons." The facts were very simple. The plaintiff had a small wine-cellar in his house separated from the hotel kept by the defendant by a party-wall only. The defendants put into their kitchen a stove so near to the wine cellar of the plaintiff, that the cellar became too hot for the storage of wine. Mr. Justice Kekewich granted an injunction to prevent the continuance of this stove. It is obvious that if this decision is good law it opens the door to a really appalling amount of litigation between adjoining house-owners. Now, as it seems to us, Mr. Justice Kekewich has been misled by the principle that a man must not use his own so as to injure his neighbour. He finds, rightly enough, that the law lays it down that, however reasonable may be the use by a man of his property, that is no answer to his neighbour's complaint that such use is injurious to him. But where Mr. Justice Kekewich has gone wrong seems to be in the application of these principles. He cites a dictum of the present Lord Chancellor that, "what makes life less comfortable and causes sensible discomfort and annoyance is a proper subject for an injunction." But is the fact that a particular spot in a house is rendered unfit for the storage of wine "a sensible discomfort and annoyance"? Let us see if we can find an answer in the dictum of the late Master of the Rolls that "serious annoyance must be caused," and that "the ordinary use and enjoyment of a dwelling house must be interfered with" in order to cause the law to step in. It is clear, as it seems to us, that to cause a cellar to become too hot for the storage of wine is not such an interference with the ordinary enjoyment of a dwelling-house as is contemplated by the late Master of the Rolls. In the case before him, the nuisance complained of was the stamping of horses in an adjoining stable, whereby the inmates of the house were prevented from sleeping at night. If those who live in a dwelling-house are prevented from obtaining their necessary rest, clearly sensible discomfort and annoyance has been proved. Mr. Justice Kekewich states that if for "horses" you read "stove," and for "sleep" read "use of cellar," "you have a test exactly applicable to the case in hand." He admits, however, immediately before, that the use of a cellar is less necessary than sleep. That admission takes away the whole value of his reasoning. It is possible to conceive that a cellar too warm for wine may be used for other purposes, such as the storage of linen, and that the wine may be kept in some other place. Again, a total abstainer would not require the use of the cellar at all, nor the prudent individual who got in a dozen of light claret when he required it. Tested in this way, it is clear Mr. Justice Kekewich was led astray by a legal maxim—otherwise every trifling discomfort caused by the use of adjoining premises would become actionable. It has never been supposed that a piano next to a philosopher's study could be removed by the Court of Chancery, but the discomfort of not being able to work without interruption is surely as material an interference with a neighbour as over-warm wine. Whether the decision will become the subject of appeal we know not, but while it stands in the Law Reports it is one which can scarcely fail to lead to endless litigation and to upset the existing give-and-take rules which alone keep the peace among neighbours in large towns.

DURING the excavations at Rome for the construction of the great drain on the right shore of the Tiber, in Via della Lungaretta, some imposing remains of a very ancient viaduct have been recently found. It consists of some arches of masonry in horizontal courses, almost Etruscan in their style. The period of its construction is not known, but from its massive nature, consisting of huge rectangular tufa blocks, and the similarity of its style of masonry to that of the tabularium of the Capitol, it is considered to belong to the same period.

SOME interesting excavations have been recently commenced by the Italian Government, under the direction of the royal inspector, Signor Orti, on the site of ancient Locri, the ruins of which exist near Gerace, a city on the south-east, on the coast of the Bruttian peninsula, not far from its southern extremity, and one of the most celebrated of the Greek colonies in this part of Italy. The date of the foundation of Locri is uncertain. Eusebius puts it at B.C. 673. At the period of Pyrrhus it appears that Locri, as well as Rhegium and other Greek cities, had placed itself under the protection of Rome. The few ruins that still remain have been carefully examined and described by the Duc de Luynes. The site of the ancient city, which may be distinctly traced by the vestiges of the walls, occupied a space of nearly two miles in length, by less than a mile in breadth. Numerous fragments of ancient masonry are scattered over the site, but the only distinct vestiges of any ancient edifice are those of a Doric temple, probably of the celebrated Temple of Proserpine, about a mile from the sea, which we know to have occupied a similar position (Livius, xxix., 18). In the course of the present researches, however, the remains of a great temple of Ionic style have been found, which are estimated to be of the fifth century B.C. This discovery is very important, because no temple of Ionic style, belonging to so early a period, has hitherto been discovered in Italy. The parts found are the following:—1. The basement and the flight of steps of the temple, formed with large tufa blocks. 2. Portions of colossal fluted columns of tufa, with traces of their capitals. 3. Some remains of marble statues,—perhaps of divinities,—and horses, also of marble, in the archaic style, probably belonging to a decorative group of the pediment. Unfortunately, no inscriptions are found, and it is, as yet, impossible to form a distinct opinion about the divinity to whom the temple was originally dedicated.

A REPORT by Dr. R. Bruce Low to the Local Government Board (Dec. 2nd) on an outbreak of diphtheria at East Haddon, in the Rural Sanitary District of Brixwood, Northamptonshire, gives the following description of the condition of drainage and water supply of this favoured district:—

"There is no proper sewerage system. The main sewer of the place is a road drain constructed some years ago by the Highway Authority. It is said to consist of 931 yards of glazed socketed pipes, varying in size from 4 in. to 12 in. . . . The house drains are very defective. In many instances they are made of field drain pipes. The size of these drain pipes is often different in the same section, and they are carelessly laid, with resulting blocks and escape of their contents through open joints into the porous soil. There are no sink stones in the houses. The slops are thrown into the open gullies, often of considerable size in the yards. Soakage of slops into the soil round the gullies was apparent. Sometimes the slop water runs in a bricked channel on the surface; here again the same sort of soakage was seen.

Excrement Disposal is by means of pit-privies, usually situated in close proximity to dwellings. The pits are mostly made with brick, the joints being often imperfect. Storm water gains entrance to some, and occasionally overflows again on to the surface. Frequently the pits are of considerable size; in some cases they extend beneath the whole of the privy itself, and can only be emptied by removing the stone flags forming the floor. They are emptied at long intervals; occasionally not for years. One such privy, which smelt abominably, had not been emptied for two years, although it was situated close to a house occupied by a tradesman and his large family. In cases where the pit is of moderate dimensions it is now and again allowed to overflow on the surface. Many of the privies are three-seated. Often they are situated near to wells. *One instance was observed in which a large privy pit*

was only 8 ft. from the well supplying several houses . . . . The water supply is derived from pump and draw-wells, the depth of which vary from 9 to 20 ft. The inside of the wells is not protected; the steining is open, and soakage of dark fluid was seen trickling between the joints of the stones. On a wet day during the inspection a considerable quantity of dark-coloured water was seen pouring into a well. The cottagers in many cases admit that the well-water is muddy and discoloured after rain. In certain cases, even in fair weather, the water actually 'stinks.' By common consent some wells are not used, their pollution is so evident. The unfortunate occupiers in such cases have to beg water from their neighbours. Almost the whole of the wells in the village are so situated as to be constantly liable to pollution from the soakage of privy-pits, refuse-heaps, slop-drains, pigstyes, and accumulations of manure."

A further light is thrown upon this pleasing picture by the note as to the provision in the district for official inspection and supervision in sanitary matters:—

"The Medical Officer of Health, Mr. F. A. Williams, is appointed for the whole of the Brixworth Rural Sanitary District, which contains an area of 60,374 acres, and had a population at the last census of 13,336. He receives a salary of 5*l.* per annum. His instructions are to undertake no inspections, and make no special reports unless he receives notice to do so from the Sanitary Authority, and for any such report he is paid a further sum of 1*l.* 1s. He is seldom required to make more than one, or at most two, reports during the year; that is to say, he is not asked to report unless something special arises. Under such terms of appointment, it is not wonderful that practically nothing is done until mischief has happened. . . . . The fault of this is certainly not due to the Medical Officer of Health, but to the Sanitary Authority, who have made it impossible for him to take any proper action. Systematic and skilled supervision of health of the district there is none, and without this no locality can be kept in a good sanitary condition."

A CORRESPONDENT, "H. R. B.," called attention in our pages last week to an old London house behind Bow Church. The house, originally two houses, is No. 10, Bow Churchyard, close to the southern side of the church. It was tenanted, until September last, by Messrs. W. Sutton & Co., patent-medicine proprietors and dealers. The house was formerly distinguished by the sign of the "Boar's Head." Its identity with the emporium of a well-known nostrum, to the ownership whereof Messrs. W. Sutton & Co. succeeded, is supported by an advertisement inserted in the *London Journal*, 1728:—

"DAFFEY'S ELIXIR WAREHOUSE.

"At the Maiden-head behind Bow Church, in Cheapside, is sold for two shillings the Bottle, that admirable Cordial, DAFFEY'S ELIXIR SALUTIS, . . . well-known throughout England, where it has been in great use these 50 years."

The numerals at the lower two corners of the mural tablet upon the western half of the house are by no means clearly to be read; they may be 69, thus making the date 1669. This sign is now worn and almost shapeless; but it is claimed to have once represented a boar's head. The early shop-fronts, with their old-fashioned shutters, are worthy of notice. The pediment of the doorway contained a carving of the royal arms and supporters in wood; this has been painted and removed to Messrs. W. Sutton & Co.'s new premises in Chiswell-street. Beneath the shield are the rose and thistle, and the bearings on the shield are probably those of our first or second Sovereigns of the line of Brunswick. As touching "H. R. B.'s" conjecture in respect of the interior fittings, we are informed by the late occupants that in the basement is a leaden cistern or tank, bearing the initials and date—T. S., 1670.

THE local Archæological Committee of Genoa has decided to perserve their historic and artistic Palace di San Giorgio, or dei Capitani del Popolo, threatened with demolition in order to set in order that part of Genoa, and thus demolish all that large quarter and change it into wide streets. The Palace di San Giorgio was built in 1260 by the Capitano del Popolo, William Boccanegra, under the direction of the Monk Oliviero. This palace is a rare example of the Lombard architecture in Liguria in the thirteenth century.

A COMMISSION of Inquiry was held in Glasgow on Friday and Saturday last week in regard to the causes of the Templeton mill disaster, Col. Malcolm, commanding the Royal Engineers in Scotland, and Mr. W. W. Robertson, Surveyor in Scotland of Her Majesty's Office of Works, having been appointed by Lord Lothian as Commissioners. Their report will not, of course, be issued till they have had time to carefully consider the evidence before them; and until the report is issued we decline to enter into any comment on the evidence, which is, however, by no means without matter for comment.

WE have received the portfolio of etchings which the Art Union of London has this year distributed to its subscribers in place of the large engravings which have been the usual staple of the annual issues. How far the change will be popular with subscribers we know not, but to our thinking the portfolio of eight etchings, though they are not all equal in merit, is very much better worth having than the single large engraving hitherto issued. Some of the etchings fail a little from over working and consequent loss of light. Among the best are Mr. C. E. Holloway's "St. Paul's from the Thames," a fine drawing with a great deal of aërial effect in it; Mr. Percy Robertson's "The Bridge," and Mr. Slocombe's "View on the Kennett." These are really beautiful works, and the others are good, if not equal to these. Taking it that the object is to bring art to the homes of the people, here are eight small works of art which will go far to lighten up a small room, instead of one large engraving out of scale with any but a large apartment: not to mention also the more delicate and tender tone of etching. The change is certainly for the better, and we congratulate the Art Union on having made it.

THE LONDON SEWAGE QUESTION.

PRECEDING the reading of Sir Robert Rawlinson's paper at the Society of Arts last week,*

The Chairman, Sir Henry E. Roscoe, F.R.S., M.P., said:—It gives me much pleasure to take the chair on this occasion, when a veteran in sanitary knowledge, Sir Robert Rawlinson, is about to give us his views on a subject of such vast importance to the metropolis as that of "London Sewage," and the purification of the Thames. It is a matter in which I myself have taken a considerable amount of interest, for, as the members present will know, I was consulted by the late Metropolitan Board of Works on the subject of the deodorisation of the effluent, and I presented to them several reports on that subject. In addition to this, I made a statement expressing my views on the whole question of the treatment of the metropolitan sewage, which has been laid before the members of the Main Drainage Committee in the form of a pamphlet. In the first of my reports to the Metropolitan Board I ventured to remark that, "looking at the broad question of the permanent disposal of the metropolitan sewage, and believing that the use of deodorants ought to be regarded only as a temporary expedient, I feel convinced that sooner or later the recommendations of Lord Bramwell's Commission will have to be adopted, and that the sewage, whether previously clarified or not, must either be filtered through land or discharged into the estuary at a point not higher than the sea reach. The growth of the metropolis during the quarter of a century which has elapsed since the adoption of the present main drainage and outfall system has been so enormous that arrangements which worked satisfactorily up to some years ago are found to be inadequate, and will, of course, become more so as time goes on." In the pamphlet above referred to, I pointed out, from a chemical point of view, that the present process of precipitation did not cause any improvement in the quality of the effluent, and, moreover, that the arrangements made for the separation of the sludge from the effluent at Barking and Crossness were, in my opinion, from a scientific point of view, based on false principles, and the consequent barging of the sludge out to sea a mistake. I also suggested that an engineer and chemist be appointed to report to that committee on the whole question of the treatment and disposal of the sewage of the metropolis, as a basis for future action. It is interesting to find that the County Council only yesterday endorsed these views, by refusing to adopt the recommendation of their Main Drainage Committee to obtain tenders for the construction of two more steamers, at a cost of 20,000*l.* each, for carrying the sludge out to sea, and by instructing that committee to secure the services of an eminent civil engineer to join the Engineer of the Council in a thorough examination of the whole sewage system. It is also satisfactory to find that the Main Drainage Committee agree with the Royal Commissioners of 1884 that it is neither necessary nor justifiable to discharge the sewage of the metropolis into any part of the Thames from the Nore upwards, and are convinced that the probable alternative to the scheme of the Metropolitan Board,—viz., precipitation in underground reservoirs, separation of effluent from sludge, and the carrying out of the latter to sea, would be in the conveyance of the sewage to the sea upon the Essex shore by some such plan as that sanctioned by Parliament in the Act of 1865. The Main Drainage Committee further add that, should separation of sludge from effluent be carried out in the future, such a separation must be conducted at Barking and Crossness. To this I should wish to add my opinion, that should precipitation not be deemed advisable, the reservoirs now constructed might still be used for storage during the flood tide, when it might be undesirable to allow the sewage to flow out even at such a distance from the metropolis. I understand that Sir Robert Rawlinson does not propose to consider the question of the chemical treatment of the sewage, and I therefore venture to make these few remarks as indicating my views of this part of the subject.

In the discussion which followed the reading of the paper,

Mr. J. G. Rhodes (late Chairman of the Main Drainage Committee of the London County Council) said he would state shortly how the question now stood, without entering into past history; but referring to the recommendations of Lord Bramwell's Committee, and showing how far they were carried out, and how far they stopped short of doing what was necessary to prove whether the plan was a success or a failure. That Royal Commission reported that it was not necessary or justifiable to discharge the sewage in its crude state into any part of the Thames. That was clearly the opinion of the Metropolitan Board; and they attempted to carry out that recommendation, and proceeded to construct the Barking and Crossness outfalls. The Commission also said that some process of deposition or precipitation should be used to free the sludge from the liquid portion, and that such a process might be conveniently applied at the main outfalls. The Metropolitan Board accordingly did so, and also adopted the last alternative suggested with regard to the sludge, that it might be applied to the raising of low-lying land, or be dug in or burned, or carried away to sea. The report also said that the sludge might be dealt with in such a way as not to be a nuisance to the neighbourhood where the process was carried on, and as a preliminary and temporary measure the liquid portion might be allowed to escape into the river, but only at a particular position. The plan had not yet been fully tried, and therefore they could not say whether the subtraction of the sludge would sufficiently relieve the river from nuisance, so that the continued passage of the effluent might be permitted. His point, however, was that the recommendations of the Royal Commission had been carried out by the Metropolitan Board as far as possible during the time they held office; large works had been erected, and in order that they might have a fair trial they ought to be allowed to remove the sludge deposited. It was not a question whether a right or wrong method of precipitation was adopted; though the one adopted was the result of observation over a large area in all parts of the country. But it had hitherto been found that when you precipitated sludge, you always had about 80 per cent. of water left in it, though possibly that might be reduced in future. The report of the committee, which was yesterday defeated in the County Council,* was in its essence a mere paraphrase of the recommendations of the Royal Commission, up to the point which had practically been arrived at. They wanted to

* See *Builder*, p. 446, *ante*.

* See *Builder*, p. 446, *ante*.

remove daily about 3,000 tons of sludge, and the simple question was what was the best method of doing so, at all events for the present. There were two sludge barges which were not adequate to the business, and therefore it was suggested that others should be added. It might be shown by and by that a cheaper mode of disposing of sludge than cargoing it away was practicable, but the first thing was to get rid of it somehow, and they had had experience of the use of ships, and knew what they could do. It seemed to him, therefore, that it was the bounden duty of the County Council to continue in the line which had been shown to be practicable, and to give a reasonable trial to these new works which had been constructed under the direction of the Royal Commission. The state of the river last summer was disgraceful,—and why? During the construction of the works it was absolutely necessary to get rid of the sewage somehow or other, and it had to be cast into the river at all states of the tide. The consequence was that the bed of the river for a considerable distance above and below the outfalls was covered with sludge; it had, in fact, been converted into a great sludge-settling tank, and that went on over a period of something like two years. Last summer it all bubbled up, and gave what was called "black water," and so horrible was the condition of things that it was necessary to deodorise the river with one of the ships. The process went on for a couple of years, but it only made itself known by the results in the hot weather, and if the sludge were not removed, next summer the same evil would be repeated and intensified. When he heard the statement that the recommendations of the Main Drainage Committee had been defeated received with approbation, he could only conclude that the danger was not apprehended by the public. If they went on pouring a portion of the sewage into the river in its crude state until other means of dealing with it were provided, they would be only preparing fresh mischief for next summer. His view was that, although there might be better means provided for getting rid of the sewage, these means would require time to think out, and Parliamentary power to carry out, and in the meantime the immediate nuisance ought to be got rid of.

Admiral Sir Frederick Nicolson, Bart., C.B. (Chairman of the Thames Conservancy Board), said that they now heard from the successors of the Metropolitan Board of Works that the river was full of sludge, but some years ago they were told exactly the reverse. Sir Robert Rawlinson had referred to the upper part of the river, and called it the "Silvery Thames," and if that portion of it had been under discussion he might have given a most satisfactory account of it, but they were dealing with another part, and a very different state of things. Allusion had been made to the arbitration between the Conservators and the Board of Works, but in that case they were unfortunately tied down by a very imperfect Act of Parliament, the clauses relating to dredging being so circumscribed that their hands were completely tied, and that was the chief reason of their failure. They had to prove, what was almost impossible, that the navigation was absolutely obstructed by certain shoals produced by the sewage outfalls. No one could deny that the traffic was going on, though just below the southern outfall, in Halfway Reach, what was once the proper channel for heavily-laden ships, which was on the south side, had become so shallow, solely by deposits from the outfall, that vessels had to go along under the northern shore, where a good deal of dredging had taken place. As they could not show that these vessels were obstructed, because they avoided deposits of mud, the case failed. He had seen, in Erith Bight, a pole pushed down 10 ft. or 12 ft. into sewage mud of the most fetid character, which was never there before the southern outfall was opened. However, he did not think the money spent in the arbitration was entirely thrown away; a great deal of evidence had been collected, and it probably paved the way for the subsequent action on the part of the Corporation of London, who brought the matter before Lord Bramwell's Commission, when the whole question of pollution was gone into, the result being a very strenuous report that the sewage ought not to go into the river at all. On one occasion, when Lord Bramwell went down to Woolwich to inspect the river, he was perfectly horrified at its condition. The whole reach was one mass of ink of the most horrible odour, and they traced this, which was supposed all to go out with the ebb tide, going up as far as Limehouse with the flood. It was only in very dry seasons and hot weathers that this extreme unpleasantness took place; but, looking at it from a seaman's point of view, if these plans for disposing of the sewage of London went on, there must be a series of shallows formed in that part of the river. His Board hailed with delight any scheme which would keep the solid contents of the sewage out of the river, which was naturally remarkably free from shoals and easy of navigation.

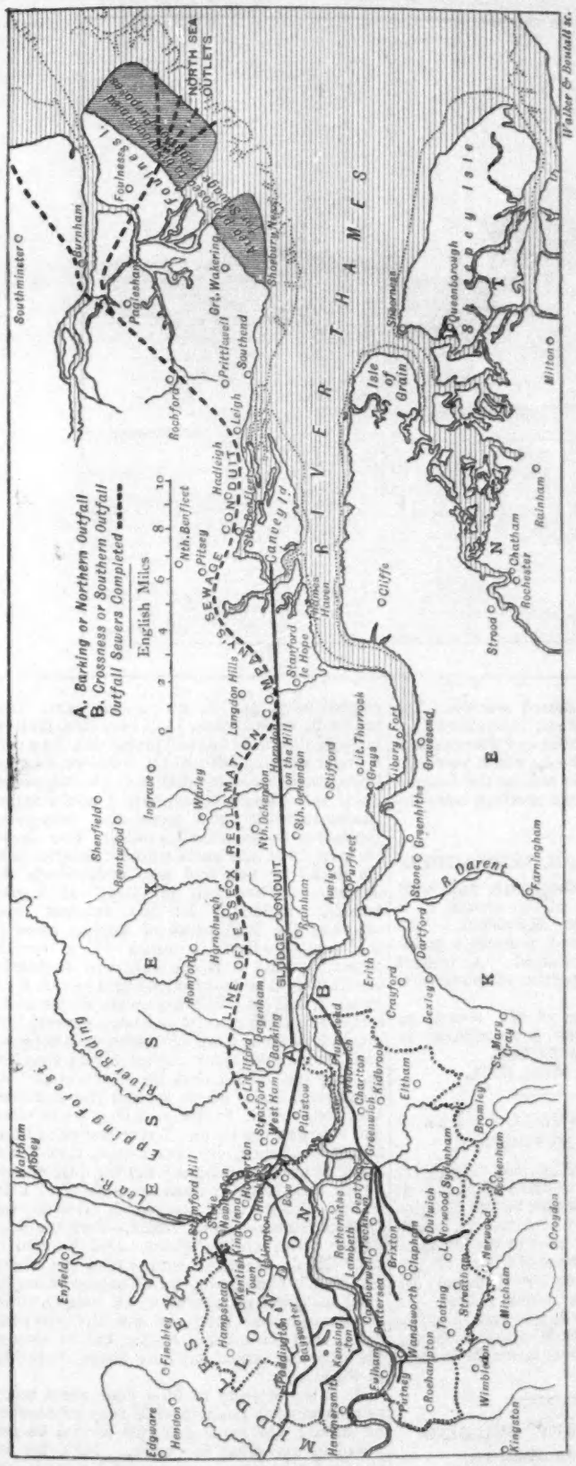
Mr. Æneas Smith said that, as a member of the Main Drainage Committee of the County Council, and the proposer of the motion that a civil engineer should be appointed to confer with the Engineer of the Council, he had declined to order more sludge ships. Mr. Rhodes spoke of the thoroughness with which this question was dealt with by the Committee, but he, as a member of it, was not at all satisfied with the present condition of things. He thought London was in a disgraceful condition in this matter, and that there ought to be a thorough and complete inquiry, and he went to the Council determined that before he would vote for the expenditure of 50,000*l.*, to be followed by one or more similar amounts, he would know what the end of the business was to be. He had very little faith in chemicals; for every fifty tons of poison which were removed, 350 tons were thrown into the Thames, and he was not prepared to see all this vile matter stirred up by the paddles of steamers, and he thought it ought to be disposed of in some other way. A great deal had been said about the expense, but that did not rest on the shoulders of the County Council, they were not responsible for the millions which would be spent at Barking and Crossness; this was handed down to them. Some of them thought it might be wise to propose a resolution that the work should be discontinued, and the contractors compounded with for what they had done, but it was found that very little saving could be effected, and, therefore, there was no alternative but to finish the contract as far as Barking was concerned; what might be done with regard to Crossness was matter for future consideration.

Dr. Alfred Carpenter said it was very refreshing to hear such a statesmanlike paper; and he commended the points which had been so forcibly put to the consideration of the ratepayers. The question raised by Mr. Rhodes as to what to do with the sludge ought not to arise, because if the sewage were dealt with properly, there would not be any sludge to remove. If a pint of beef tea were kept for a few days there would be plenty of sludge, but there was none there the first day or two. As soon as putrefaction commenced an immense amount of sludge was formed, and the great principle in dealing with sewage was to keep it moving until it was delivered on to the land. There were two things greatly needed at the present moment in London—meat and milk, and yet they were proposing to pour sewage, which would produce them both, into the sea. The ratepayers must not look to derive any profit from the utilisation of sewage; they would have to do as other localities did, provide an area of land on which it could be utilised, and let the agriculturists have the profit to be derived from its use. If the London County Council would bear this in mind, and provide land—either where Sir Robert Rawlinson suggested, or at Canvey Island, or, as he would suggest, on some of the waste lands round London, which were calling out for sewage—they would find thousands of acres not worth 5*s.* an acre which could be made to yield an average rental of £5 an acre, and the difference between those two figures would provide a fund out of which to pay interest on the capital required. This question was of the utmost importance to the nation. He had watched the utilisation of sewage on land for twenty-five years, and he could say that the subsoil was almost as pure a yard down as it was before it was used. The growth of crops had removed all this stuff which was spoken of as sludge, and it had been formed into meat and milk, and added materially to the wealth of the district. The death-rate of London was low, but nothing like so low as that of the area he referred to round the sewage farm, containing a population of 5,000; the death-rate during the last ten years had never risen above 14, and it was not on account of a low birth-rate, for that was 34. There was an entire absence of zymotic disease. He hoped the County Council would take the matter up seriously and devise measures for preventing the evils which would otherwise come upon them, not immediately, but in a hundred years' time, and which would not only make the neighbourhood much more unhealthy than it had ever been, but would prevent the river being what it had hitherto been—a highway to the Port of London.

Colonel Jones, V.C. (Wrexham), said he could entirely endorse what had been said by Dr. Carpenter. He had been living on a sewage farm for eighteen years, and had enjoyed the best of health, and so had his family. He found every drop of sewage valuable, and had generally managed to satisfy the Corporation to whom he was Sanitary Engineer. He was now engaged in carrying the sewage of Wrexham two miles further to a new farm, solely because the present farm had been so improved that the landlord would not treat for the sale of it at any reasonable price. If a little place, with a population of 12,000, could afford to take its sewage two miles, the City of London could well go twenty miles to Canvey Island; which Sir Robert Rawlinson had indicated as the first outfall. That island contained nearly 5,000 acres, which would suffice for the solid and most offensive part of London sewage for many years, and surrounding it on the coast of Essex there were immense areas of land which would benefit by having sewage poured upon it. He looked upon Canvey Island as a sort of safety-valve and experimenting ground to which the Metropolis could carry its sewage, and be content only to take it elsewhere when there was a demand for it. At Wrexham he found the tenant of the new farm to which the sewage was to be taken was only too delighted with it, and his own successor intended to continue it. In the same way, if an experiment were made at Canvey Island on a small scale, there would soon be a demand from the neighbourhood. With regard to the question before the County Council, he might mention that a proposal had been made by his partner, Mr. Bailey Denton, and himself to relieve them of the expense of ships to take the sludge to the Nore, by laying down a 12-in. pipe in duplicate, about 4 ft. above the surface, along the Essex coast, to conduct the sewage under pressure. They had been advised, too, that the existing engines and pumps were capable, with very slight alteration, of putting pressure on sewage in a 12-in. pipe equal to 200 ft. head, if required, to drive the whole of the sewage in a semi-liquid state—and if it were not liquid enough it might be made so—to Canvey Island, where it could be disposed of in improving and raising the land to the level of high tides, which at present had to be banked out.

Dr. Charles Drysdale said that all European nations were looking to England for a solution of the sewage question, and many of them had sent engineers over here to study what had been done. Paris had now a very successful sewage farm of 1,500 acres, which produced most magnificent crops, and the effluent was so pure that any one could drink it, as he had done himself. In Berlin, also, where the authorities had sent engineers to study English sewage farming, they had now about 11,000 acres on the north and south, and not a particle of sewage was now sent into the river. It all went on the land, winter and summer, and Professors Virchow and Koch both said the effluent water was the purest to be found anywhere. Yet London, the Metropolis of the world, still continued the ridiculous system bequeathed to it by the Metropolitan Board of Works, which was silting up the river, and causing it in the neighbourhood of Woolwich to be most pestilential in summer, and all the valuable manurial products of the population to be wasted. It was the same with Dublin and Glasgow; these three towns were a disgrace to civilisation. Every possible plan had been tried, and it was well known now that the only possible way of purifying sewage was by passing it through fitting soils. On the proposed line to the North Sea there were at least 40,000 acres which might easily be bought at a cheap rate, and would soon be found profitable. Two hundred thousand cows could be fed on the grass and root crops which could be raised upon them, and then London would be able to get a supply of milk, which was much wanted.

Sir Robert Rawlinson said he would remind Mr. Rhodes of one fact,—viz., that the so-called clarified sewage, though it might look perfectly clear, was truly polluting sewage, and when it went into the river it was as capable of producing a stench and doing mischief, as it was with the



MAP OF THE COURSE OF THE THAMES, FROM LONDON TO THE SEA:

Showing the Proposed Outlets for Sewage to Canvey Island and the North Sea.

*** We are indebted to the *Journal of the Society of Arts* for the use of this block, but the references in the upper part of it are evidently not correct. A and B correctly represent the position of the Northern (Barking) and Southern (Crossness) Outfalls, but the thick dotted line obviously does not represent "outfall sewers completed," but the line of outfall proposed some years ago by the Essex Reclamation Company, and now again put forward, substantially, by Sir Robert Rawlinson. The straight thick line represents the sludge conduit from Barking to Canvey Island proposed by Mr. Bailey Denton and Colonel Jones. The thin dotted line represents the boundary of the Metropolitan area, lately under the authority of the Metropolitan Board of Works, and now ruled over by the London County Council. It will be observed that this area extends some distance further eastward on the south side of the river than on the north side. The main sewers of the Metropolitan main drainage system are six in number,—three on each side of the river, and known as the Northern or Southern low-level, middle-level, and high-level sewers respectively. On the north side these three main sewers converge, as will be seen, in the neighbourhood of Bow and Hackney; on the south side the convergence takes place in the vicinity of Deptford and Greenwich.

sludge, minus one point in eight. At Leamington the A B C people proposed to make a valuable manure by their chemical process, but they were driven out of the place because the effluent they sent out polluted the river, and they were restrained by injunction. He had purposely avoided going into the question of irrigation in any detail, though no one in the room had had wider experience of it. He had officially examined every sewage-farm in England, and many of the large ones abroad, and he could say, confidently, that if sewage were to be put to its best uses, and dealt with so as to occasion the least loss, it should be put upon land. If he had proposed, however, to make sewage farms all the way down from Barking, he knew many people would say he was going to poison all the wells and create a nuisance, and therefore he had provided a conduit, without saying anything about utilising it on its way to the outlet. He was quite certain, however, that as soon as the landowners and farmers saw the value of it, every acre of land along the conduit would be glad to have the sewage, and before many years every gallon would be taken before getting to Canvey Island, and none would have to go into the sea. The legacy which the Metropolitan Board had left their successors with regard to the sludge treatment, was one of the most outrageous things of modern times. They ought to have known that what they termed clarified sewage was not clarified so as to prevent it being mischievous. When he held the inquiry at Barking, they told him there was no crude sewage going into the Thames, and found witnesses to swear there was no deposit at Barking, when at the very time there was 10 ft. or 12 ft. of sludge. Yet he was obliged to report that it was not proved that the mud came out of the Metropolitan sewers, because there were so many men swearing it did not. He was sorry for the way the Conservators were beaten in their action, but it was proved in the arbitration that no sludge went into the Thames to be dredged; but where did the 3,000 tons every week come from? There had been no creation of sludge since that period. When the inquiry was held, it was stated that the tanks were to receive the sewage, and that none was to enter the river except two hours after the turn of the tide. It was then going in at all states of the tide, had done so ever since, and would continue to do so. The best thing for the County Council to do would be to abolish all methods of dealing with the sludge, establish a conduit as shown on the map, and deal with it on the land. There would not be any profit on it, but the income would be far more than enough to pay the interest on the money required to promote the conduit.

Mr. W. C. Sillar wished to say that there was not a word of truth in the statement as to the A B C process at Leamington. It was only tried there on sufferance for two years while land was being prepared for an irrigation farm, and when the term expired, they received the thanks of the Corporation, and every satisfaction was given while it was in operation. As to an injunction, he did not know where Sir Robert Rawlinson got his information from, but it was entirely without foundation.

Sir Robert Rawlinson said the Earl of Warwick told him he would obtain an injunction, so that the A B C Company was removed by the terror of an injunction if not by its actual operation. The river was most abominally polluted by the effluent.

Mr. Sillar repeated his denial of this statement.

The discussion was adjourned to Wednesday, January 5.—(Slightly abridged from the *Journal of the Society of Arts.*)

COMPETITIONS.

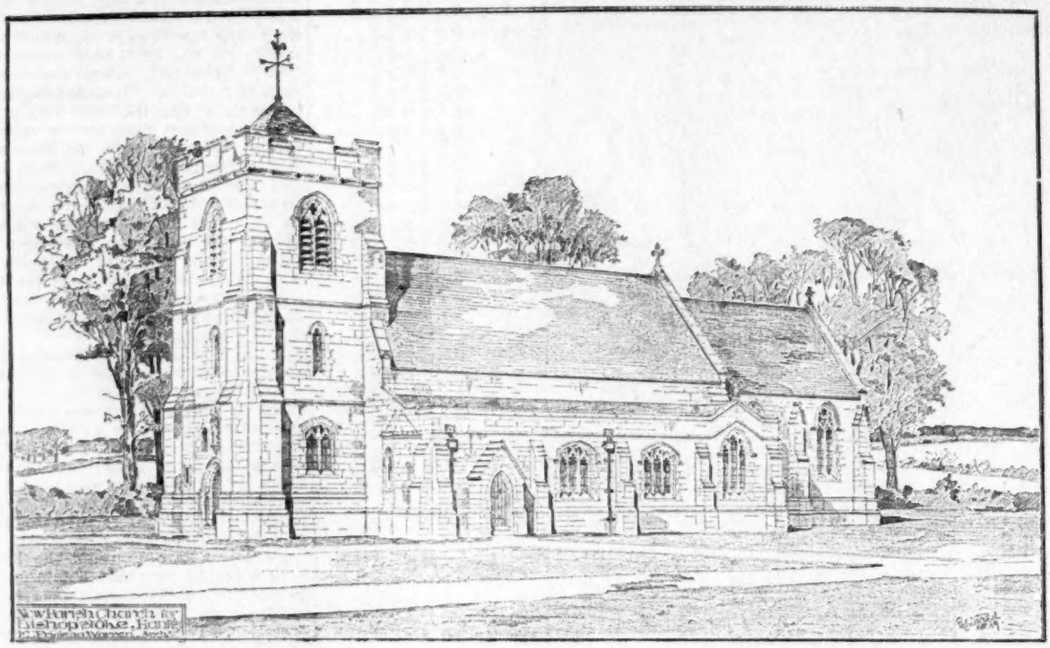
Board Schools, Burnley.—A special meeting of the Burnley School Board was held on the 19th inst., when the report of the assessors (Messrs. W. Waddington & Sons) on the competitive plans for the proposed Board School in Burnley Wood were considered. A resolution was passed accepting their award, and it was decided that the premiums be given as recommended:—First, 30*l.*, Mr. G. T. Lawrence, London; second, 20*l.*, Messrs. Smith, Woodhouse, & Willoughby, Manchester; and third, 10*l.*, Mr. Thomas Bell, Burnley. The first prize will merge into the commission if the architect carries out the work. The question was referred to the Building Committee to seek an interview with Mr. Lawrence, with the view of seeing if an arrangement could be made with him to carry out his design. So says the *Burnley Gazette.*

Chapel, Blackburn.—The designs of Mr. Fredk. W. Dixon have been selected in a limited competition for the re-building of Zion Chapel, Montague-street, Blackburn. The present edifice was erected in 1837, and has now become inadequate to their requirements. The new building will be on the amphitheatre plan.

Freckleton-on-the-Ribble Sewerage.—At the monthly meeting of the Fylde Union Sanitary Authority, held at Kirkham on the 11th inst., Mr. W. S. Hodgson in the chair, it was resolved, on the recommendation of the Freckleton Parochial Committee, to make application to the Local Government Board for power to carry out the scheme of sewerage for the district of Freckleton submitted by Mr. William Wrennall, C.E., of Liverpool. This scheme was selected as the best in an open competition under motto, and, accordingly, was awarded the first premium. Mr. H. B. Nicholl, C.E., of Birmingham, obtained the second premium, and Messrs. Brierley & Holt, engineers, of Blackburn, the third.

Schools, Southport.—In a limited competition at Southport, for new Sunday schools for the London-street Primitive Methodists of that town, the designs of Mr. Frodk. W. Dixon, architect, of Oldham, have been selected by the committee. The new buildings, which are to be faced with Ruabon bricks, with stone dressings, are estimated to cost about 2,500*l.*

Rangoon Drainage and High Pressure Water Supply Works on the "Shone" System.—Messrs. Hughes & Lancaster inform us that the opening of the above works by H.R.H. Prince Albert Victor has been included in the programme of the visit to Rangoon.



NEW PARISH CHURCH, BISHOPSTOKE.

The new parish church now in course of building at Bishopstoke, Hants, is to form a substitute for the existing church,—a small, ill-built, and exceedingly ugly structure of some sixty years' standing, and described in Murray's Guide as "modern and hideous." The new church is being built upon an entirely new site, and a very attractive one; an acre of land having been presented to the parish by Mr. Alfred Barton to form the new churchyard. The church consists of nave, chancel, western tower, choir and clergy vestries, and one aisle on the south side. The walling is of flint rubble and brick; the internal face of brick, to be ultimately plastered; the external face of snapped flint, with quoins and dressings of Bath stone. The roofs are to be covered with local red tiles. An unusual feature of the design is the little semi-octagonal baptistery at the west end of the aisle. The church is to seat 350.

The builders are Messrs. Wheeler Bros., of Reading; the architect is Mr. E. P. Warren, of London.

Illustrations.

INTERIOR, CHRIST CHURCH CATHEDRAL, OXFORD.

THIS cathedral interior, as restored by Sir Gilbert Scott, with its mixture of styles, among which the Norman is predominant and seems to form a solid skeleton for the whole, is exceedingly picturesque. The cathedral is one of the smallest in England. It was originally but a priory church, and was only erected into the cathedral of the diocese by King Henry VIII., four years after the dissolution of the monastery. The dedication to St. Frideswide, presumably a Saxon saint, may point to the existence of a church on the spot at a very early date. Mr. Roper's sketch, if a little spotty in the foreground, is, in all other respects, a very beautiful and accurate drawing.

The original drawing was in the last Royal Academy Exhibition.

THE LIBRARY DOOR, SIENA CATHEDRAL.

This Illustration is a reproduction of a drawing in colour by Mr. T. MacLaren. In the original the doorway was drawn to inch scale, and the details to one quarter real size; the scale of the reproduction is a little less. The design is free from the bastard Gothicism which pervades the cathedral as a whole, and has all the delicate refinement of the earliest phase of the Renaissance. The treatment is very suggestive of a reasonable and effective method in the use of valuable coloured marbles. The library, or Sala Piccolominea, is celebrated for the beauty of the miniatures and illuminations in the twenty-nine choir books, which now comprise the whole collection; and for the frescoes that adorn the walls, some of which were designed by Raphael.

CHURCH OF ST. ALBAN, TEDDINGTON.

We give this week the north and west elevations and the plan of this church as it is intended to be when completed. The design, it will be observed, includes a morning chapel beyond the chancel. At present only the chancel and a portion of the nave is being carried out.

We gave an interior of the church as intended, accompanied by a description, in the *Builder* for September 29, 1888.

The architect is Mr W. Niven, F.S.A.

THE ALGERIA PAVILION AT THE RECENT PARIS EXHIBITION.

We do not know whether this very pretty example of the minor buildings of the Paris Exhibition is to be preserved, but we imagine that, being only imitative architecture, it will have to go. It stands or stood at the left-hand side at the top of the Avenue of Oriental buildings which was formed on the Esplanade des Invalides, and with its white plaster and coloured tiles had a very bright and sparkling effect. It was designed by M. Albert Ballu, the talented inheritor of a great name in modern French architecture.

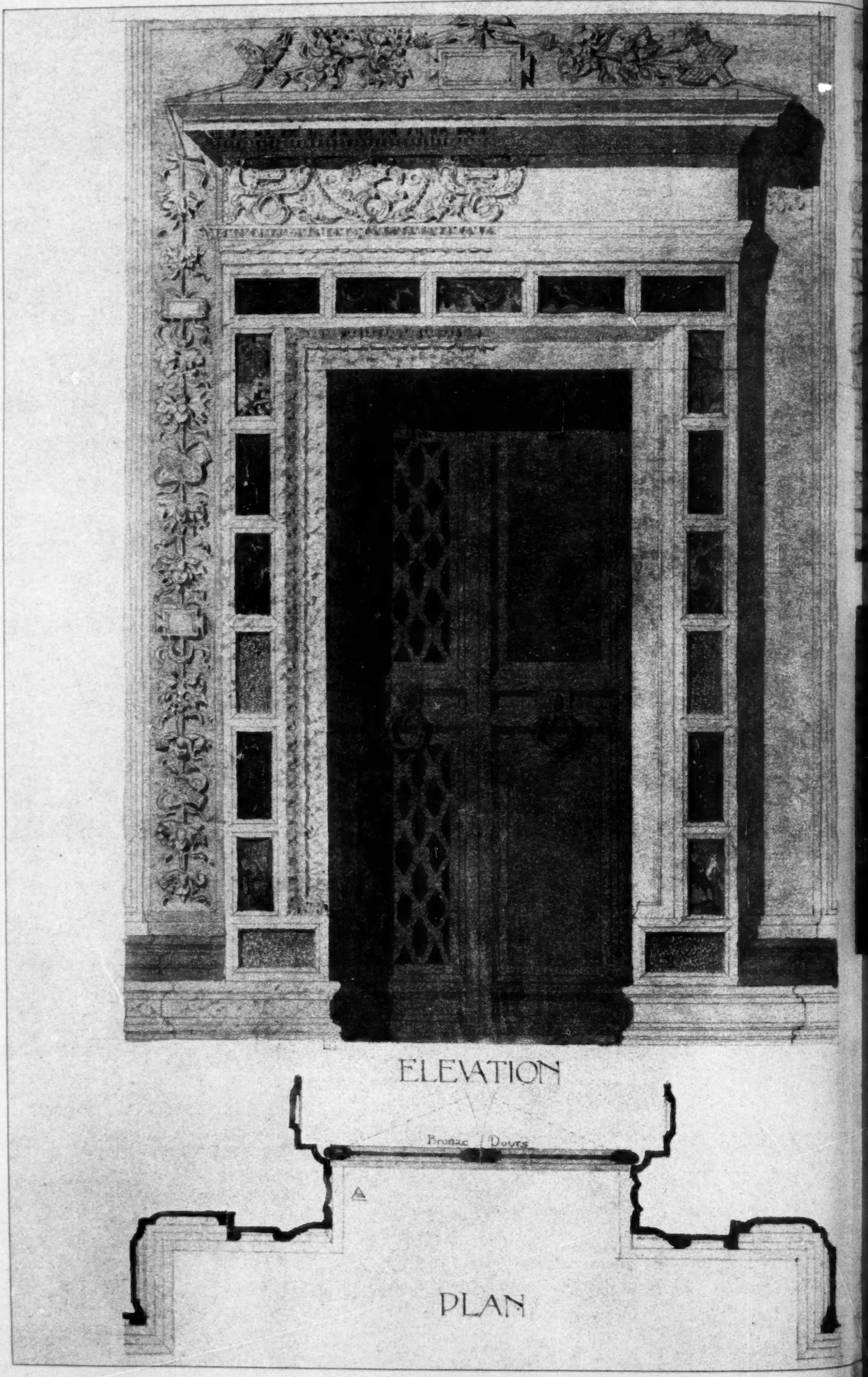
THE ART OF JERRY BUILDING.

BY ONE WHO PRACTISES IT.

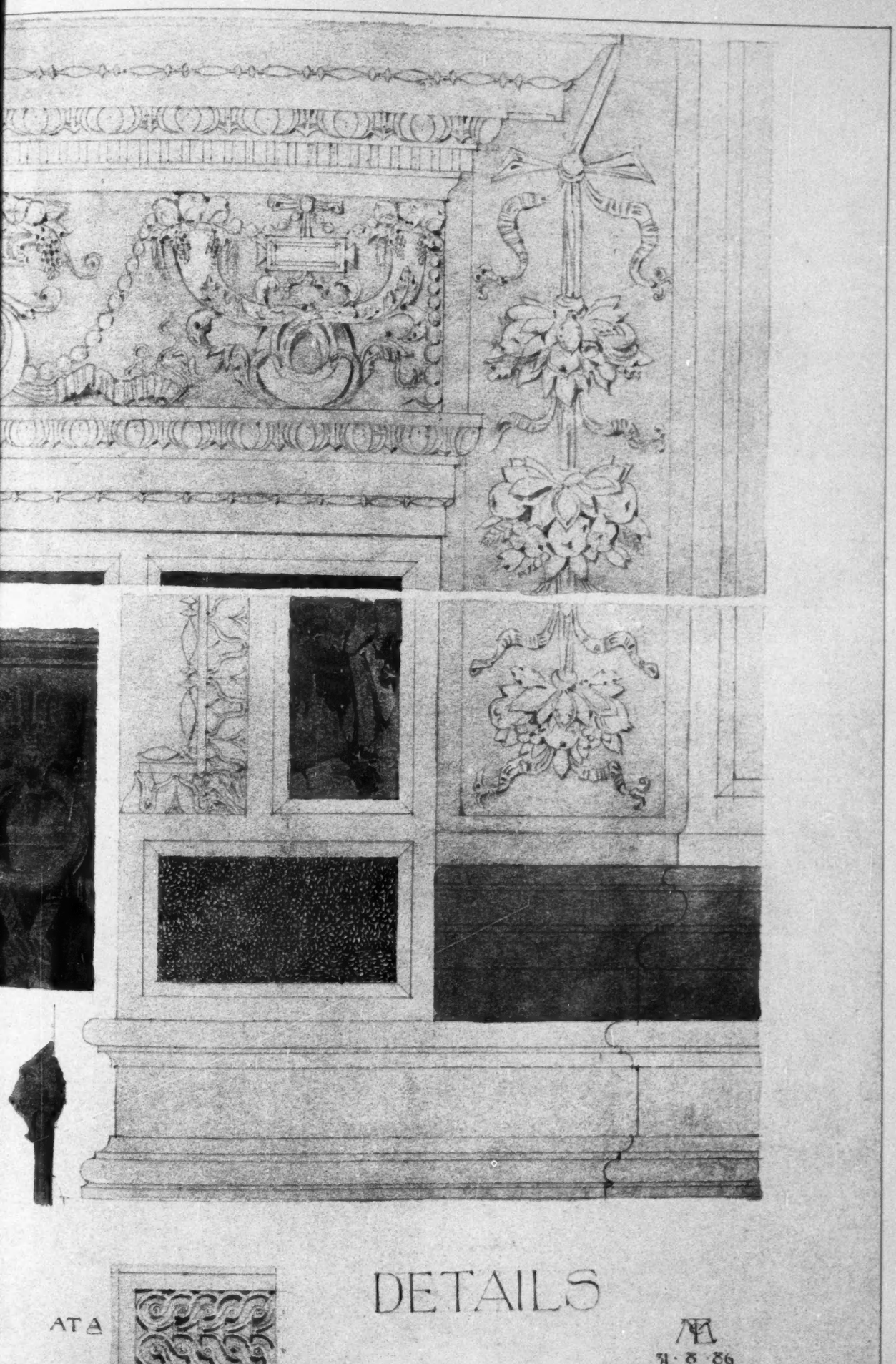
Out of fellow-feeling for others in the building trade, towards whom I would scorn to cherish any sentiments of ungenerous rivalry, I think it right to initiate them into some of the principles by which I have been guided for many years in the conduct of my business,—principles which, I can truly testify, have been largely conducive to my financial success. I am, and always have been, what is called a jerry-builder. In my youth I well remember being filled with just indignation on hearing some one repeat that ribald adage, "Fools build houses for wise men to live in." I since became inspired with an ambition to reverse the proverb in its application to my own case; and I think I have fairly succeeded in doing so. I think I may venture to style myself one of the wise men who build houses for fools to live in.

As regards my principles, I would advise every young man starting in business to inscribe them upon the tablets of his heart. The first object is, of course, to get work; and I say emphatically, get it, no matter how. If I tender in competition, I cut low, and trust to lumping it on in extras and provisions. As a rule, I prefer working without an architect, because these gentry are so inquisitive and meddlesome; but if this cannot be avoided, I would rather choose to work under some nice, easy-going gentleman in an official position, who draws his salary just the same whether he attends to his duties or not, and who understands the doctrine of "live and let live." In buying building materials, let me impress upon everyone the importance of buying those of the best quality. I mean to a certain extent, because it is the only way to inspire confidence. For instance, when I've got a job on hand, and the building-owner or his architect comes on to the site to have a general look round, he sees a heap of bricks, we'll suppose, and he remarks what capital bricks they are. So they are,—those that lie on the top. My men always know where to find the materials that they've got to use, and they know when and where to use them. I recollect once I had a mound of nice, dry, fine mould, that I was going to use in mixing my mortar. Of course, I took care to cover it over to a depth of 2 in. or 3 in. with the best sharp sand. One day the District Surveyor came round,—they're always prying about, those fellows,—and he said to me, "That's beautiful sand you've got there, Mr. ——." That shows the advantage of having good materials on the site. Of course, while the surveyor was there, he saw the best sand being used for mixing mortar, but as soon as his back was turned, my men began shovelling in the mould.

As it is necessary to hide your worst materials as much as possible while they are stacked on the site, the same principle should be followed in executing the work. Thus, for instance, I always use up my worst bricks in my footings—that is, when I build any footings at all. I remember once, when I had built a brick pier without footings, the District Surveyor, unfortunately, came and saw it before the earth had been filled in. He drew my attention to it, and of course the first thing I did was to turn round and scold my foreman for allowing the footings to be omitted. "I declare," said I, "if I don't look after every little thing myself, something is sure to go wrong." The surveyor said that the pier must be pulled down and rebuilt with proper footings, and I promised him that it should be done. He then asked me why I did not discharge my foreman, if I found him so careless. I told him that they were all alike,—one was as bad as another; and that I might only make a change for the worse. He went away, looking very thoughtful; and, as soon as he was well of sight, my foreman and I went and had a pint together, and enjoyed a good laugh over the business. There was, of course, no necessity to pull down the pier at all.



THE LIBRARY DOOR, SIENA CATHEDRAL.—FROM ELEVATION AND DE



AT A

DETAILS

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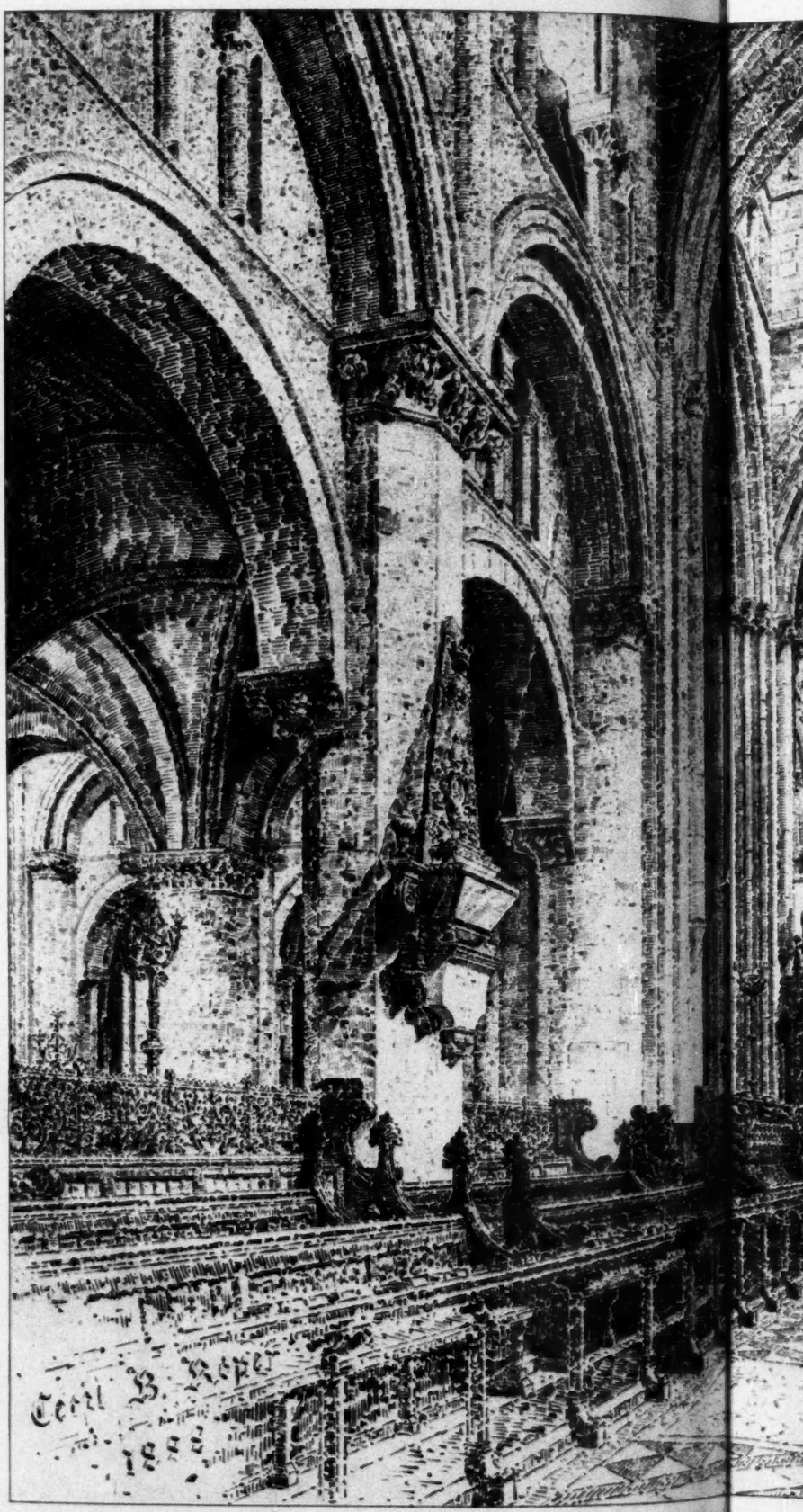
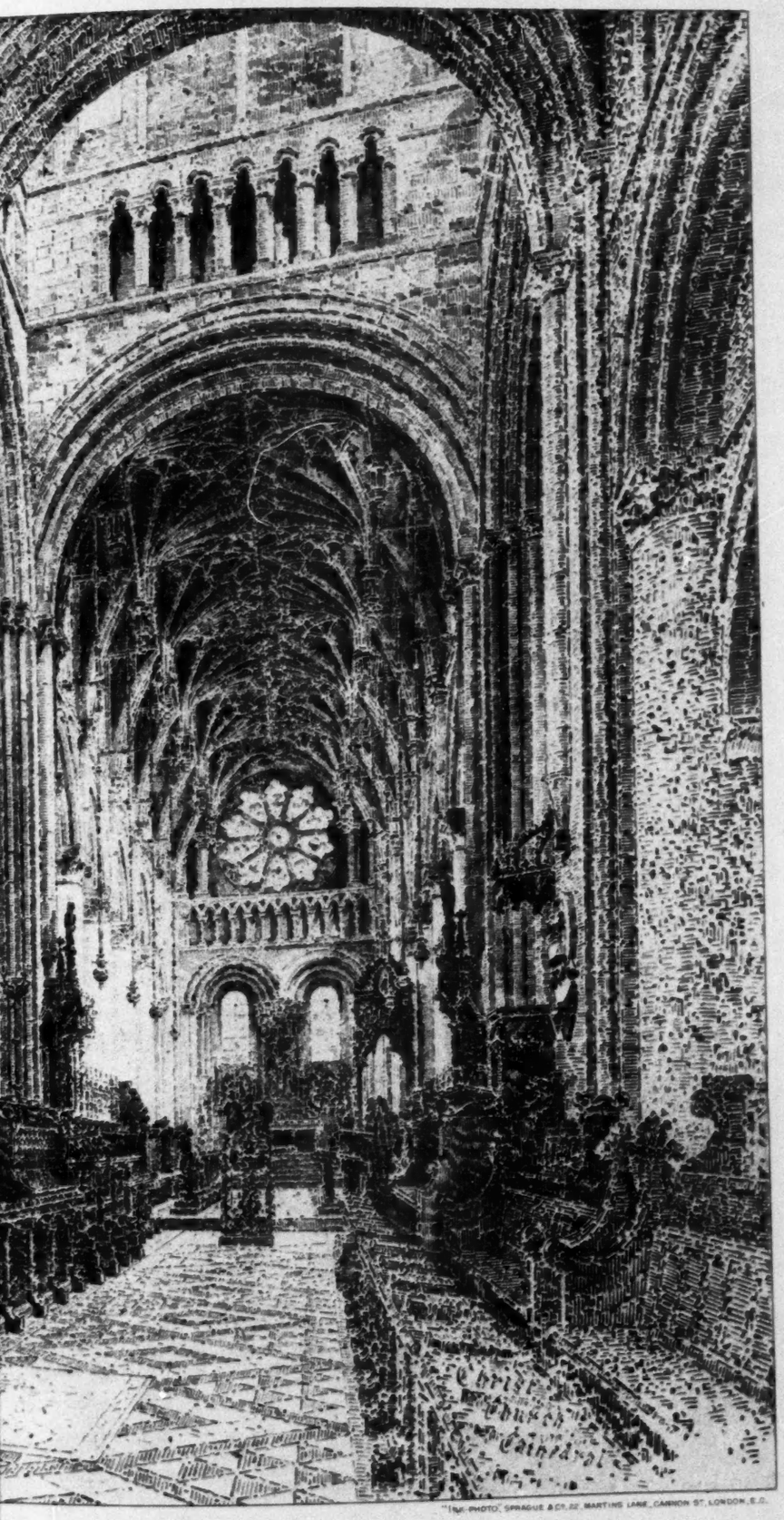
INK-PHOTO, SPRAGUE & CO. 62 MARTINS LANE, CANNON ST., LONDON, E.C.

—From a Drawing by Mr. Thos. MacLaren.
ND DETAILS.

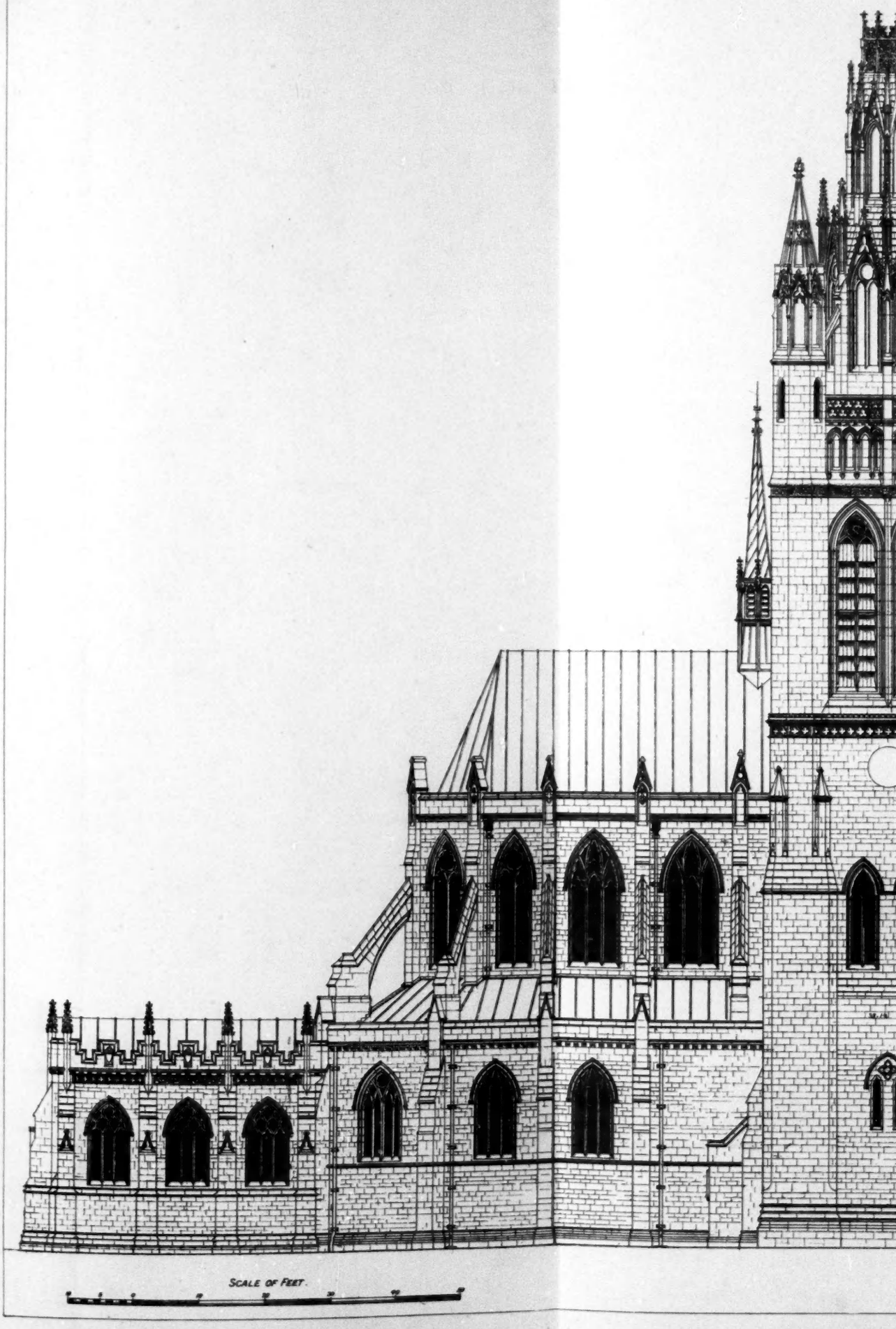


INTERIOR, CHRIST CHURCH CATHEDRAL, OXFORD



"LINE-PHOTO," SPRAGUE & Co., 22, MARTIN'S LANE, CANNON ST., LONDON, E.C.

OXFORD.—From a Drawing by Mr. Cecil B. Roper.



CHURCH OF ST. ALBAN, TEDDI

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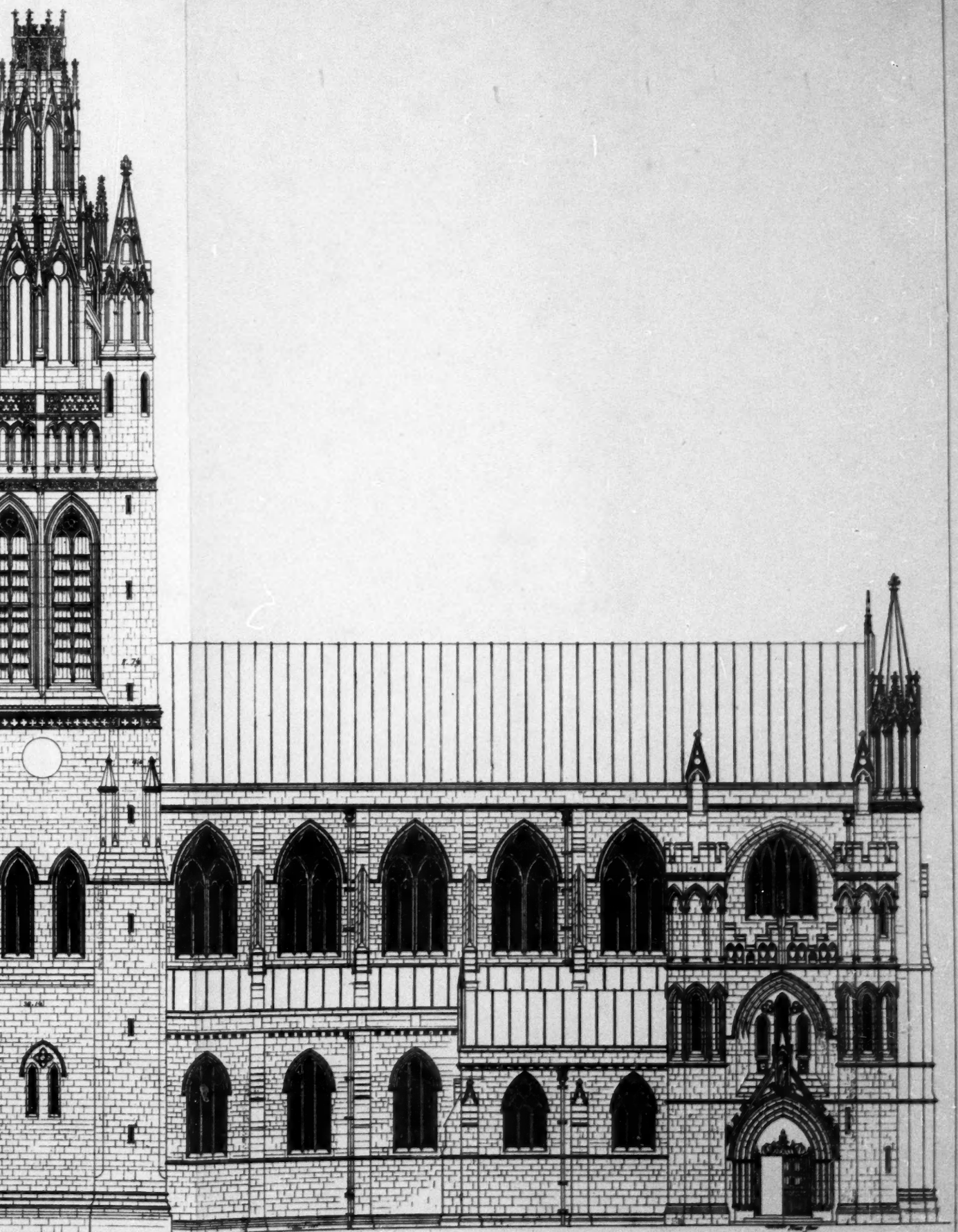


PHOTO-LITHO. SPRAGUE & CO., 63, MARTINS LANE, CANNON ST., LONDON, E.C.

TEDDINGTON.—Mr. W. Niven, F.S.A., Architect.

NORTH ELEVATION.

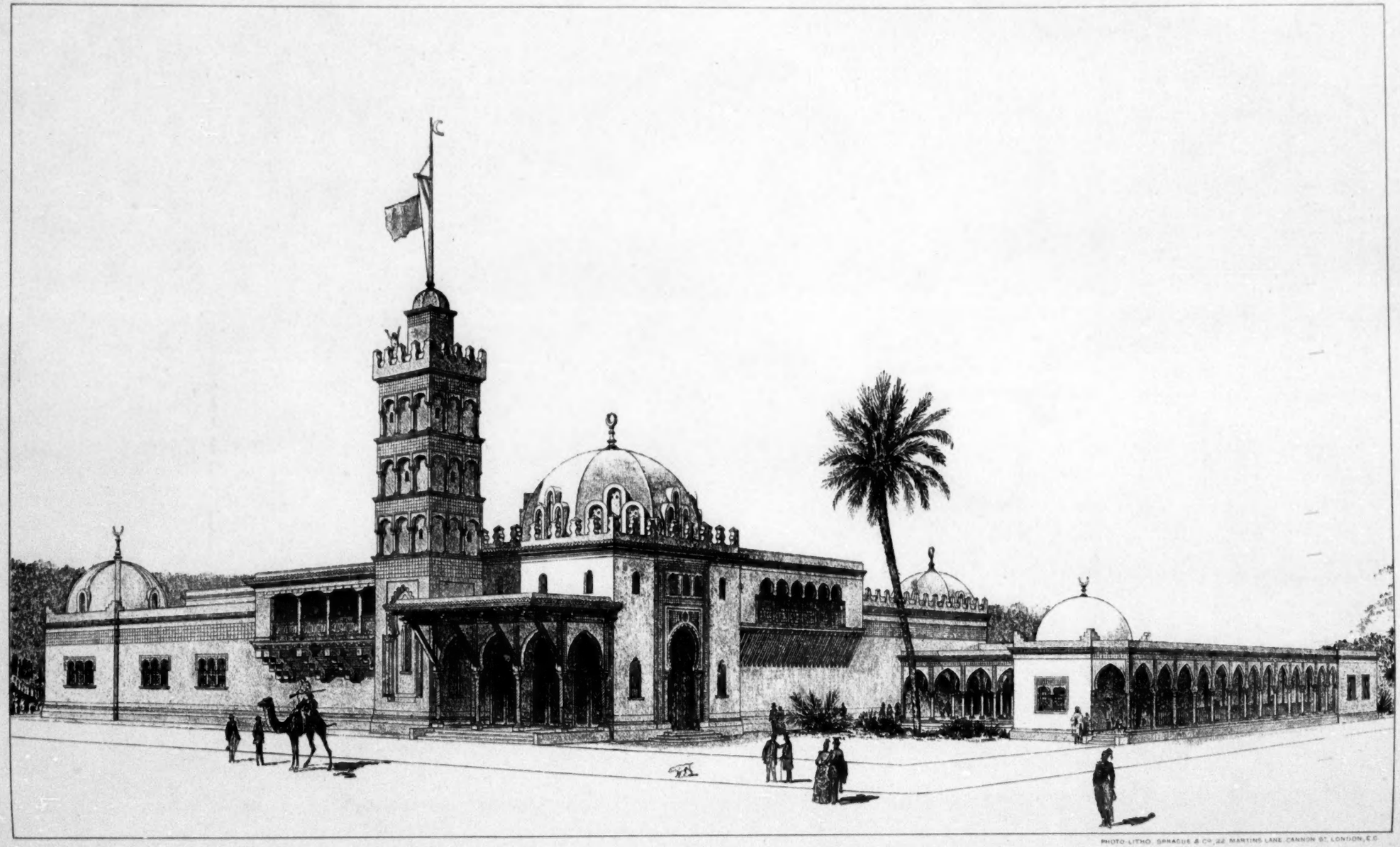


PHOTO-LITHO. SPRAGUE & Co. 22, MARTINS LANE, CANNON ST. LONDON, E.C.

THE ALGERIA PAVILION AT THE RECENT PARIS EXHIBITION.—M. Albert Ballu, Architect.

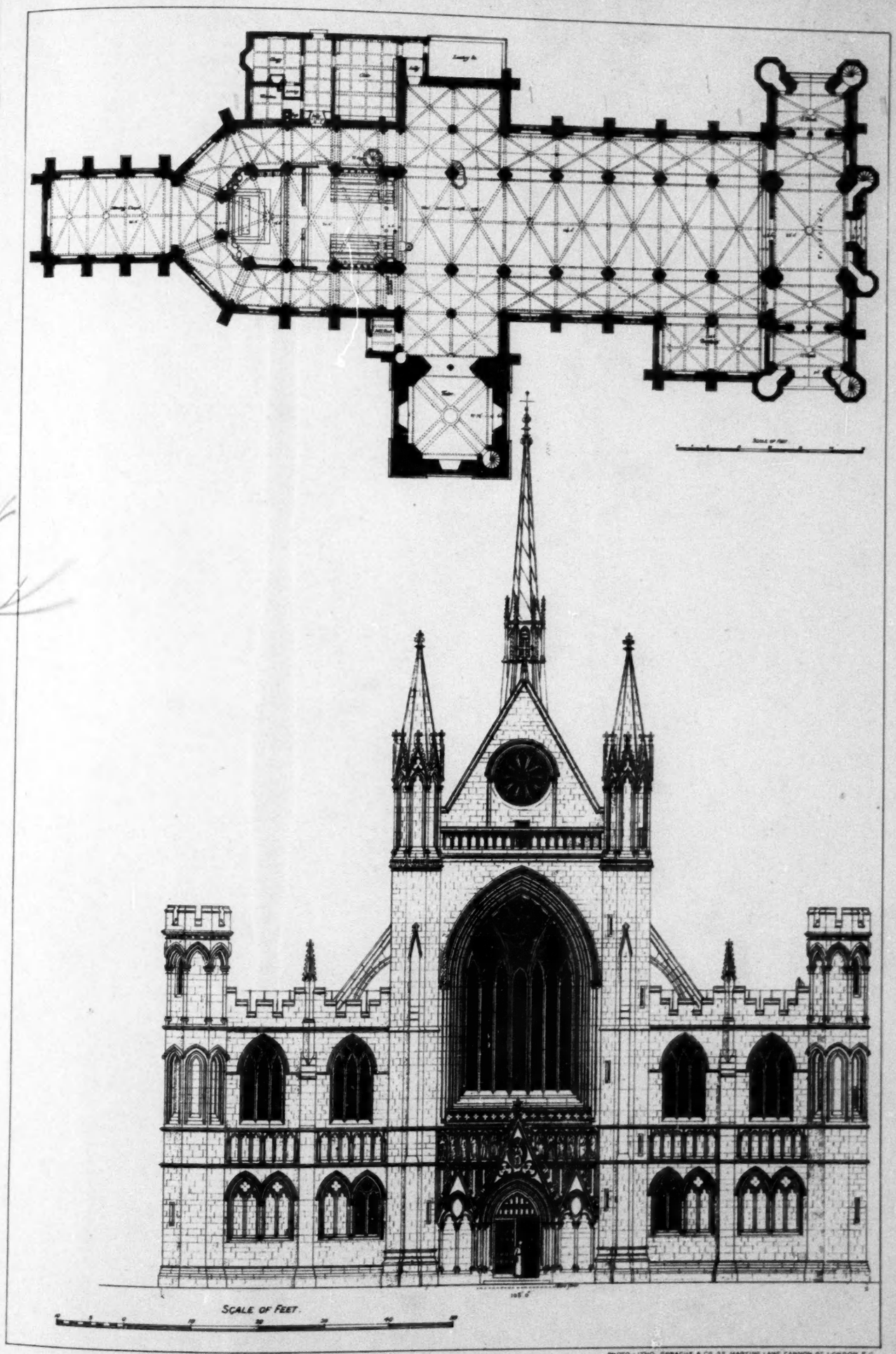
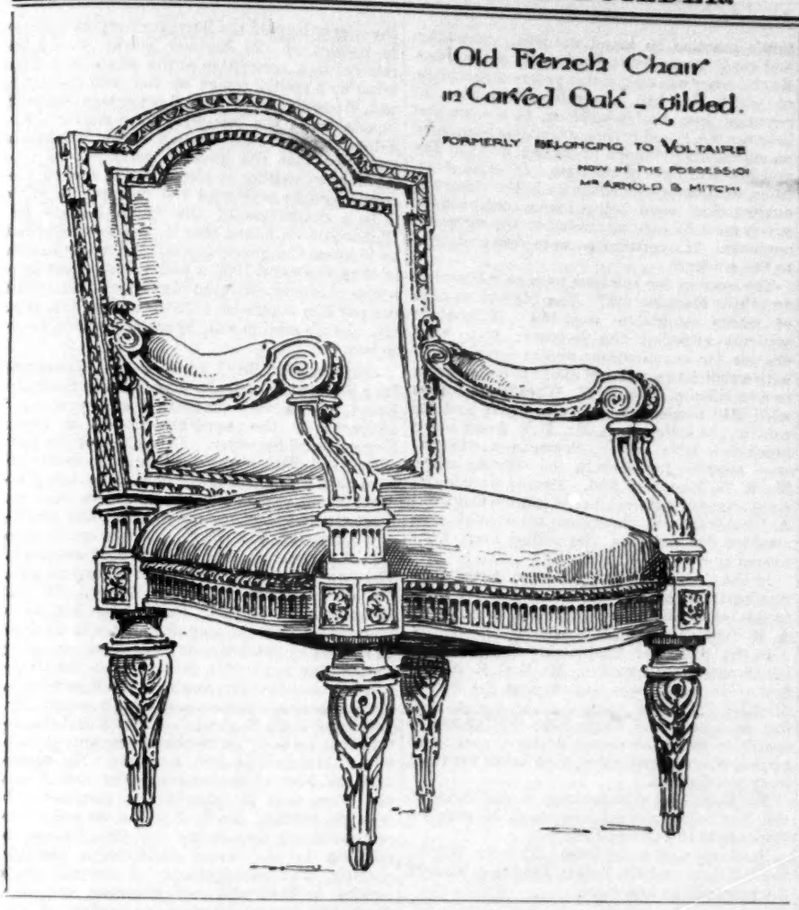


PHOTO-LITHO. SPRAGUE & CO., 62, MARTINE LANE, CANNON ST., LONDON, E.C.

CHURCH OF ST. ALBAN, TEDDINGTON.– Mr. W. Niven, F.S.A., Architect.

WEST ELEVATION AND PLAN.



We only had to set to work with some bats and closers, and build footings up against the pier just as it stood. When the surveyor saw these footings, he was perfectly satisfied, and rather complimented me on the rapidity with which the work had been done; and I may say that I am a great believer in pushing work on rapidly, although this should, of course, be done with proper discretion. For instance, when the architect or surveyor is absent, you cannot go to work too quickly in using up your place-bricks, faulty stone, and green timber, provided that these things do not show too conspicuously in the building. But when a surveyor is looking on, you must let him see good materials being used, and then you don't want to work quickly, because you must not use them up too fast. But it is as well to let your men make as much noise and dust as possible, because these things help to keep inquisitive people away. As a rule it is better to make the works difficult of access to visitors, and for this purpose mortar, lime, and stacks of bricks may form useful impediments to a tour of inspection. Many persons are in favour of not laying any planks across naked flooring, or only a single plank at most, if wheelbarrows have to pass over. I know that this plan has its advantages. It may prevent an elderly or timid surveyor from inspecting some parts of a building, especially if he would have to walk over joists about an inch thick and loose at one end. But, on the other hand, such an arrangement might cause an accident to one of the men, and it is just as well to remember that there is an Employers' Liability Act. For my part, I am in favour of putting down plenty of planking because it helps to hide the sappy timber.

I have referred to the necessity of pushing on the works rapidly, and that, of course, in a judicious way. Sometimes it is necessary to make a good show of work in order to get a payment from the building-owner. I was once building a terrace of ten houses. I had got them all roofed in, and the architect said he would certify for another payment as soon as the sashes were fixed. When he came down to inspect the works, I had just got enough sashes on the site for two houses; so I told him that all the sashes were just then being fixed. When I took him into the first house he saw the sashes, which had just been fitted into the openings, and the same in the second house. I kept him in the second house, talking to him and pointing out the beauties of the work here and there, while my men took the sashes out of the first house, and were busy fixing them in the third house when the architect and I went into it. In this manner, we went over the whole terrace (for the architect was a most particular man); and, when I had shown him all that I wanted him to see, I got him to jump into my trap, which I had ordered to be ready at the end of the terrace, and I drove him to the railway station by what I called a short cut, so that he did not pass the works. The next day he sent me the required certificate. Thus, my readers will see that, by the exercise of a little tact and ingenuity, I have been able to conduct my business with satisfaction to others as well as to myself.

A. Jerry.

OLD FRENCH CHAIR.

This is an example of a late French Renaissance chair said to have been at one time the property of Voltaire. The treatment of the legs is weak; otherwise it is a good example of the style and date to which it belongs.

NEW SANITARY DEPÔT AT HORNSEY.

Mr. H. R. Williams, the Chairman of the Hornsey Local Board, gave the following address descriptive of the new sanitary depôt at Hornsey, on the occasion of its formal opening on the 13th inst. by Mr. R. D. M. Littler, Q.C., Chairman of the Middlesex County Council:—

"One of the chief difficulties besetting local authorities in their efforts to promote more perfect systems of sanitation is, to know what to do with the contents of the domestic dust-bin, which too often is the receptacle of every kind of accumulated garbage, and not unfrequently becomes, from its contiguity to the dwelling-house, a veritable death-trap. Sanitary engineers and scientists have long devoted their energies to minimise the danger arising from this unsavoury receptacle, and to devise means for dealing with the noxious matter which it contains without creating fresh nuisance, but the only successful plan as yet proposed for efficiently dealing with it is that of burning.

This subject had for some time engaged the attention of the Hornsey Local Board, while the ever-increasing annual cost for the collection and removal of house refuse formed a heavy item in their successive balance-sheets. As the Sanitary Authority of the District, it appeared to the Board that their primary duty was to obtain the best information possible upon this grave and, for the most part, neglected subject. They accordingly instructed their engineer, Mr. T. de Courcy Meade, to visit the various towns in which the dust destructor (or as it might be more aptly designated, the 'dust purifier,') was in use with more or less success, and to report to them generally upon the subject. After extensive inquiries, and with the assistance of the best engineering and scientific advice they could obtain, they at length resolve to build what, with the surroundings, may be called a sanitary depôt, the principal item of which forms a destructor for the economic dealing with the dust and house refuse, which will henceforth be collected by their own staff, brought to the depôt in covered carts, and at once tipped into the furnaces, no accumulation whatever being allowed. The importance of this step will be best understood by sanitarians, when it is mentioned that the population of the Board's district, which in 1881 was 22,485, is now estimated at 43,000, the number of houses having increased in the meanwhile from 4,043 to 7,400.

Having acquired the necessary land, the Board, in the first instance, erected a public mortuary, with coroner's court, a waiting-room, two mortuary chambers, post-mortem rooms, laboratory and caretaker's cottage.* Subsequently a range of buildings, containing steam laundry, disinfector, fumigator, and ambulance sheds were built, together with a range of stabling for twenty horses and a horsekeeper's cottage; finally, the buildings in which we are now met, for the treatment of house refuse, viz., furnace-house, engine-house, cremator, mill-house, boiler-house, cart-sheds, smithy, carpenters' workshop, stores, and a chimney-shaft which stands on the north side of the boiler-house, and is a fine specimen of the builder's art.† It was erected principally with London stock bricks. Its total height from the bottom of foundation to the coping is 244 ft., the height from the ground line to top of coping being 217 ft. The outside diameter at ground surface is 18 ft. 3 in., the inside diameter 12 ft. 3 in. The foundation bed is of clay, 27 ft. below the ground line; on this a block of concrete 39 ft. square is laid, containing 927 cubic yards of Portland cement concrete; the brick footings are 33 ft. square at the base, and are built up to ground line with regular offsets. The total weight of the shaft above the concrete is 1,141 tons. In the construction of this chimney 300,000 stock bricks were used, 16,000 blue bricks, 14,000 fire bricks, and about 3,000 glazed white bricks. The weight of the Portland stone cap is 24 tons. Special care has been taken to protect the shaft from lightning. The time occupied in building the shaft was a little over five months. It was commenced in July, 1888, and finished in December. The bricklaying was continued all through the foggy weather, the workmen having a clear light at 150 ft. high, although they could not see through the fog below.

The refuse furnaces at present consist of six separate cells, forming a block of brickwork 25 ft. long, 24 ft. 6 in. wide, and 10 ft. high, to which others can be added if necessary. The doors have wrought-iron baffle-plates perforated for the admission of air to keep them cool. The top of the furnaces forms a level platform from which they are fed with refuse through hoppers. On each side of the hoppers are cast-iron doors for the inspection of the gases passing from the furnaces before entering the cremator. The gases are conducted from the furnaces by a large flue to the cremator (the invention of Mr. C. Jones, C.E., of Ealing), where they are subjected to a temperature of about 1,600 deg. F.; they are conducted from thence either through a by-pass flue, or round the tubes of a Babcock & Wilcox's multitubular steel boiler to generate steam which is conveyed to the engine-room for working a horizontal high-pressure expansion engine. In the flues three dust traps are constructed with baffle-walls to check the rush of dust along the flues. Pits are placed in front of the baffles with sliding covers, so that any dust which finds its way into the flue is quickly precipitated into these pits, from

* Plans and descriptions of these buildings were given in the *Builder* for February 5, 1887.

† Described in the *Builder* for January 26 last, in a letter by Mr. R. M. Bancroft.

which it can be easily removed without stopping the working of the furnaces. In connexion with the large steam-engine there is an exhaust injector, fed from a thousand-gallon tank direct into the boiler by means of exhaust steam, at a temperature of 100 deg. The mill-house contains an ordinary mortar-mill for making mortar, the clinker, when ground, forming an excellent grit for that purpose; also a clinker-mill for breaking the clinker into small pieces suitable for concrete, the gritting of roads, and other purposes. The bulk of clinker and fine ash is about 25 per cent. of the refuse consumed, and consists of a mass of fused matter, all organic substances having been consumed by the intense heat in the furnaces, which decomposes the offensive material contained in the collected refuse. Ample space is provided in the yards for storing the clinker, which will be used principally in the making up of roads and footpaths, for which it is admirably suited.

The machinery connected with the destructor works was supplied by Messrs. Goddard, Massey, & Warner, of Nottingham. The shaft and other buildings connected with the destructor were erected by Mr. Charles Wall, of Chelsea, and cost, with the machinery and extra foundations, 8,006*l.*; the stabling, cart-shed, and stores, were built by Messrs. Rudd, of Grantham, and cost 1,540*l.*; the mortuary buildings cost 2,800*l.*; the total cost of the land (exclusive of three-quarters of an acre conveyed to the Board in exchange for the site of the old lock-up), amounted to 950*l.* The whole of the buildings have been erected in a substantial manner, and from plans prepared by the Board's engineer, Mr. T. de Courcy Meade, to whom much credit is due for his skill and painstaking care."

The "destructor" and its accompanying arrangements appear to act very perfectly, and without nuisance. On this point it was stated that the "destructor" had already been at work for two months without the residents in the neighbourhood being aware of the fact, and that there had been no complaints, although, now that the public opening has taken place (Mr. Williams slyly remarked), the Board expect to receive complaints. Hornsey, it appears, is highly favoured in that its rates are low, although its sanitary condition is very well cared for; but it was explained that, although the rates were low now, they were once higher, owing to the heavy first cost of efficient sanitary works. Permanent economy of administration, it was remarked, was dependent upon wise and judicious, even if heavy, expenditure at the outset; this, at any rate, was declared to be the experience of Hornsey.

CRYSTAL PALACE SCHOOL OF ENGINEERING.

On Saturday this institution completed the seventeenth year of its existence. Mr. James Abernethy, C.E., F.R.S.E., Past President of the Institution of Civil Engineers, presided, and presented the certificates awarded by the examiners, who were on this occasion—for Mechanical Engineering, Mr. D. K. Clark, C.E., M.E.; Civil Engineering, Mr. R. Barker, C.E.; Electrical Section, Mr. Leonard Milne, B.A., B.E., &c.

The retrospect suggested by the close of another year shows a remarkable development in the number of pupils attending, and in the scope of the instruction and training imparted. The school opened seventeen years ago with nine pupils; when Mr. Abernethy presented the certificates twelve years ago the number of students had increased to fifty; during last term the number of students in attendance was one hundred and seven. As regards scope of instruction, new sections have been added to the original course, viz., the Colonial, Electrical Engineering, and Marine Engineering sections.

Mr. Shenton read the Examiners' report, which was highly laudatory of the character of the school, and of the course pursued by Mr. Wilson, the Principal, and his staff, and commendatory of the work of the students in the various departments.

Mr. Abernethy, in a practical address, urged the students to make the most of the great advantages they enjoyed in the thorough system of theoretical instruction and practical training that they passed through in this school; to remember also that these must be supplemented in after-life by incessant and vigilant study of engineering progress. After nearly half a century's practice, he found watchful observation and study necessary to keep up with the times. Engineering was eminently a progressive science, of which they had a notable illustration, as regarded iron bridge-building, in the contrast between the Menai Bridge, which was considered an engineering triumph in its day, and the Tay and Forth bridges of our time. In other structures, also, enormous advances in the science of construction were being made continuously, which must be carefully noted by the successful engineer. The certificates were then presented to the students.

The lectures for the term were on "Materials and their Manufacture." The highest number of marks attainable was 284. Fifty-eight students attended the lectures; fifty were eligible for examination; twenty-seven passed with a sufficient number of marks to entitle them to a certificate. Mr. F. W. Wheadon was first with 249 marks; he was also equal first for work in the fitting shop, Mr. E. V. Acton being bracketed with him. Fourteen certificates were awarded for work in the drawing office Mr. R. W. Maudslay first. Twenty certificates were awarded for work in the pattern shop, Mr. A. Woodhill first. Seventeen certificates were awarded for work in the fitting shop, firsts named above.

In the Civil Engineering Section, twenty-two certificates were awarded, the firsts in the three terms being, respectively, Messrs. E. M. Proes, A. M. Struben, and R. B. Motley.

In the Electrical Engineering Section, eight certificates were awarded, Mr. E. C. R. Nelson first. Mr. Nelson was also awarded the Bronze Medal of the School, being the fifth student who has achieved this distinction, the necessary condition being the award, during the student's course, of nine certificates, none below the third in order of merit.

Mr. E. B. Hall was awarded a certificate in the Marine Engineering Section; as were six students in the Colonial Section.

Brief appropriate addresses from Mr. Wilson, the Principal, and Mr. Barker, Examiner, brought the proceedings to a close.

SURVEYORSHIPS.

Appointment of Surveyor to the London School Board.—At the meeting of this Board, on the 19th inst., the Works Committee reported as follows:—"In accordance with the resolution of the Board of Nov. 14, 1889, the Committee have inserted advertisements in the *Times* and five other weekly journals, inviting applications for the appointment of Surveyor to the Board. In reply, the Committee have received seventy-three applications, and nine of the applicants were selected and seen by the Committee. They now beg leave to recommend for appointment Mr. W. S. Cooke. Mr. Cooke is 45 years of age, was for 7¼ years engaged in making surveys and valuations for the Great Western Railway Company, and has since been engaged in private practice. The Committee recommend:—

"That in accordance with the resolution of the Board of November 14, 1889, Mr. W. S. Cooke be, and he is hereby appointed Land Surveyor and Valuer to the Board, at the commencing salary, under the scale, of 500*l.* per annum; that he be required to give his whole time to the service of the Board; that the appointment be on probation for a period of twelve months; and that it be subject to three months' notice on either side for its termination.

"That the engagement of Mr. Cooke, referred to in the preceding resolution, be subject to the resolutions of the Board of January 26, 1888, with reference to the superannuation scheme; and also subject to the production of certificates of health and of birth."

This was agreed to.

Darlaston.—A special meeting of the Darlaston Local Board was held at the Town Hall on the 19th inst., for the purpose of electing a Surveyor in the place of Mr. Debney, resigned. The Clerk reported that thirty-three applications had been made for the position, and it was decided to reduce them to five. The voting was by ballot, and in the end ten members voted for Mr. J. C. Joynson, of Darlaston, and ten for Mr. A. Wilkes, of Willenhall. The Chairman gave his casting vote in favour of Mr. Joynson, who was declared elected. The salary commences at £120 per annum.

Torquay.—At a meeting of the Torquay Local Board a few days since, considerable discussion took place upon a motion by Mr. Allams in regard to the recent increase of the salary of Mr. Hall, the Surveyor, from 350*l.* to 450*l.* a year. It was proposed that the resolution adopting this should be rescinded, and that the question of the increase of salary, and also of the sum to be paid the Surveyor for past services in respect of the harbour works, should be referred to a committee of the whole Board to bring up a special report at the next meeting, and, if possible, to propound some legal mode of liquidation of the last-mentioned matter.—Mr. Tripe seconded the motion.—The Chairman remarked that the present arrangement was satisfactory neither to the Surveyor nor to the public, and he supported the proposal to refer it to a committee of the whole Board.—Dr. Richardson explained that it was not intended to increase the Surveyor's salary for any length of time, the extra 100*l.* a year being to pay him a sum of money owing to him which they could not pay him otherwise without acting illegally. Mr. Allam's motion was defeated by nine votes to two.

Johannesburg (South Africa).—The *Johannesburg Star* of the 27th ult. says:—"The Sanitary Board took a very important step yesterday afternoon in the appointment of a Town Engineer and Surveyor. The salary of the new officer is 1,200*l.* a year. The post seems to have been a much-coveted one, there being no fewer than twenty-nine applications sent in. From these thirteen were selected, and yesterday afternoon the Board met in committee for the purpose of making the final selection. The number was by degrees reduced to two, the choice lying between Messrs. W. H. Miles and De Villiers. On a ballot Mr. Miles was elected, and the appointment will have to be ratified by the Board at its ordinary meeting on Monday next. Mr. Miles is comparatively new to Johannesburg, having arrived here but a few weeks ago. Some years ago, however, Mr. Miles was Town Engineer at Port Elizabeth, so that that he is by no means unacquainted with South African life and manners. He comes with the best of credentials. For some years Mr. Miles was in practice at Bournemouth with his brother, Mr. C. T. Miles, as engineers and architects, and during that time he had, in addition to the usual fashionable sea-side practice, the management of several large estates in that and neighbouring counties. Singularly enough, during a portion of the time Mr. Miles was in practice at Bournemouth, Mr. Andrews,* the new General Manager of the Waterworks Company, held the appointment of Town Engineer; and he is, therefore, able to speak from personal experience of the excellence of Mr. Miles's work and of his entire fitness for the post to which he has just been appointed."

EXAMINATIONS FOR PUBLIC SANITARY INSPECTORS.

On Saturday evening last, at the meeting of the Association of Public Sanitary Inspectors of Great Britain, held at Carpenters' Hall, the discussion on the papers read by Mr. Hugh Alexander and Mr. Robins† was resumed, Mr. Robins again attending and Mr. Alexander again presiding. Before Mr. Tidman, C.E., the first speaker in the debate, was called upon, a letter received from the Clerk of the London County Council was read by Mr. Legg, the hon. sec., replying to a letter to the County Council from the Association, calling the attention of the County Council to the desirability of a consolidation of the various Sanitary Acts. The London County Council states that its Sanitary Committee has from time to time considered the matter to which attention was called, and that it would continue to make every effort as opportunity occurred to remedy the unsatisfactory state of the law.

Mr. Tidman, in resuming the discussion, expressed the opinion that the constitution of the examining body of the Sanitary Institute would be greatly improved by the exclusion of some of its theoretical elements in favour of practical ones, by the admission to seats at the Board of men having a sound knowledge of the actual duties that the sanitary inspector was called upon daily to carry out. As an inspector of dead meat he had to have the knowledge both of a butcher and a veterinary surgeon, and in other circumstances he required the knowledge of a chemist as well as that of a plumber, a builder, and a decorator. The work of the sanitary inspector was of vast importance to the community, and if candidates possessing merely the certificate of the Sanitary Institute were to

* Mr. G. R. Andrews was subsequently, for a few months, Borough Engineer of Brighton, a post which he resigned to go to Johannesburg.

† See *Builder* for Dec. 14, p. 422.

be accepted by the community as competent for the proper performance of the duties of the office, a severer test than that at present applied ought certainly to be required from the Sanitary Institute.

Similar views were expressed by Mr. Davenport, C.E., Surveyor and Sanitary Inspector, by letter; and in the discussion by Messrs. Edwards (Southwark), Osborne (St. Pancras), Fairchild (Clapham), Legg (secretary), and other members, and by Mr. Hugh Alexander, the Chairman, who wound up the discussion before calling upon Mr. Robins to reply. Mr. Fairchild pointed out that in corporate subjects the City and Guilds of London Institute did exact such preliminary practical knowledge as they were contending for in their candidates, and he could not see why the Sanitary Institute should not follow that good example.

The Chairman said he was satisfied with the course of the discussion on the subject, and with the comments *à propos* to it which had appeared in the *Builder* and other organs of the press. The discussion could not fail to prove of the highest service. Mr. Legg and others had pointed out the desirability of having members of the Association upon the Board of Examiners of the Sanitary Institute; and a younger Association than theirs, which had done the latter the honour of copying it in almost everything, had demanded from the Institute that two members of their body should be placed upon the Board. In the medical and other professions, men without practical knowledge would never be permitted to practise; and seeing to what an extent the care of the public health was committed to the sanitary inspectors, it ought to be considered equally intolerable to admit men to practise the duties they had to perform. How was it possible that such duties could be properly performed where there was no special training beyond a three months' course of cram, not above the capacity of a retired soldier, a railway porter, perhaps a tinker, or a tailor? He agreed with Mr. Richards (Battersea) in believing in the necessity of pressing forward towards a higher degree of education and towards an accord with the Sanitary Institute, but he also agreed with the remarks of the Secretary (Mr. Legg) in thinking that more confidence would be inspired in the certificates and the examinations of that body if its board of examiners were more largely composed of practical men.

Mr. Robins, on rising to reply, said he felt justified in thinking the members of that Association regarded him as a friend to them, whatever might be the result of the discussion, and however much they might differ in opinion. He reminded them that he had declared that in his opinion, certainly, practical knowledge was necessary for the sanitary inspector to enable him to do his duty, and that he had looked to them to furnish him with certain information to enable him effectively to maintain that position. He had wished them to point out by reference to their actual work what kind of practical knowledge was required, and to what extent it should be considered an essential. He had not got much information, and he confessed that, judging from the earlier portion of the discussion, he did not expect to get much from them. For that reason, he had asked for a copy of the last report of as many of them as possible to be sent to him at his office, so that he might be able to judge to what extent the sanitary inspector should know "Building Construction." Only four papers had been sent in,—viz., from St. Giles's, from Leek, from St. Mary's, Battersea, and from their Chairman (Mr. Alexander). He considered it very important, if he was to defend the question for them, that they should furnish him with those papers. There were members of the Institute who held the opinion that it was not necessary for those seeking inspectorships to have that technical and practical knowledge which they and he insisted upon in order to enable the men appointed to carry out properly their duties; and papers such as he had asked for would have enabled him to meet the arguments of such members. The Association would do well to see what could be done to get people outside itself to support its views. He had suggested the Royal Institute of British Architects because it would have more influence for their benefit than any other body. It might be true that not every British architect had so extensive a knowledge of sanitary science as was desirable. The British architect ("many of us," said the speaker) did not know much about it many years ago, but he had learned a good deal since then, and they (the sanitary inspectors) would have to learn a good deal more too. It would not be just in him (the speaker) to take the lowest man among them and hold him up as an example of the sanitary inspectors as a body, and they must not take the lowest of the British architects to represent the Institute. It had men on its Council who were determined to press forward the claims to consideration of sanitary science, and who had proved themselves among its best friends. Some remarks had fallen from their Chairman with reference to a proposal he believed of Sir Edwin Chadwick (the whole country knew how much they all owed to Sir E. Chadwick) to apply to Mr. Ritchie to receive a representation. But much care should be taken as to the manner in which they made the application. If it was to meet with perfect success, it must be supported by facts gathered outside their Association. Theirs was not the only body interested in the matter, and a representation from it should be accompanied by representations from other bodies. These representations should be made not only through the Royal Institute of British Architects, but through the Surveyors' Institution and the Sanitary Institute, as well as through the Association. If all these bodies were to come in to help them, the representations of the Association would be much stronger. The Chairman (Mr. Alexander) had reduced the whole contention to the question of the examination tests of the Sanitary Institute, which, he maintained, ought to exact more practical knowledge from candidates. If only those who had practical experience, or held the certificate of the Science and Art Department, could receive the certificate of the Institute, then in future no candidate possessed of a less qualification could be admitted. Such a change would require the most serious consideration. That proposition made in favour of having two grades in their own (the Association's) constitution. He was of opinion that the first step to take was to apply to the Royal Institute of British Architects for a definition of the status of the Sanitary Inspector, and he would conclude by proposing a resolution to that effect. He was very hopeful that they would get a leg-up from the Royal Institute of British Architects, and that they might have the same reason to feel grateful for its intervention as the Willesden Board. That Board having a great deal of land to let, and a great many houses to build upon it, had sent to ask the Royal Institute if it would tell them what sort of person they ought to appoint as Surveyor of these new buildings. It had done so with the best results. The Royal Institute of British Architects might be trusted not to favour the employment of incompetent inspectors. He was glad to learn, as he had that night, that they (the public sanitary inspectors) looked to the Sanitary Institute to be their leader. It had architects, engineers, and professors of hygiene among its members, and a number of their own body. If the Sanitary Institute opened its doors entirely to them it would to others—to the Institution of Civil Engineers as well as to the Royal Institute of British Architects, and the Institute of Surveyors. It must not be supposed that he was the mouthpiece of any of these bodies. He did not represent the Sanitary Institute in any way. The Institute left him to do as he pleased. He might have his own opinion upon any of these matters; he should have the task of defending them (the members of that Association) rather than anything else. He represented himself and no other body. He was of opinion that the public sanitary inspectors should receive greater consideration. They did the dirty work and should have the benefit of their devotion, and all the consideration should be shown to them that might be shown to others. Mr. Robins then concluded by proposing the following resolution:—"That the Council of the Royal Institute of British Architects be asked to define the present status of the sanitary inspector; and having regard to the obvious intentions of the Sanitary Acts of Parliament, the experience of their working since acquired, and the duties actually devolving on such officers, to further define what ought to be the qualifications of candidates for the said office."

The Chairman suggested that it would be better to refer the resolution to the Council of the Association for consideration before proposing it as a resolution to the general body, and a number of members preferring that the resolution should be put forthwith, the Chairman's proposal was made an amendment. Both motion and amendment having been seconded, the amendment was put first, and carried by fourteen votes to eleven. It was then put as a substantive resolution and carried *nem. con.*, Mr. Robins agreeing that the best course had been adopted.

The business concluded with a cordial and special vote of thanks to Mr. Robins. Mr. Robins having acknowledged the vote, and some announcements having been made by the Chairman and the Secretary, the proceedings closed.

PROPOSED AMENDMENT OF THE METROPOLITAN BUILDING ACT.

SIR,—Having been away for some time, I have not had an opportunity of seeing the wording of Clause 70 in the above, referring to the limit of height of new buildings, and to which you call attention in your leader of this week.

There can be no doubt that this clause may have, if not very carefully considered and worded, a most pernicious effect on the future of our street architecture.

We are but now escaping from the dreary and monotonous horrors of Belgravia or Bloomsbury, flanked by long lines of level topped ugliness, each house front no better than a rectangular box with holes in it.

Surely it would be reasonable to make the limiting height line proportioned to the width of the street; and so to word the clause that where, as in many cases, every inch of height must be used, gable-fronted houses need not be prohibited. It might be specified that the total area of the house front should not, when reduced to a rectangle, exceed some limiting line of height. When gables were wanted their apices would exceed the limiting line, but the springing must necessarily be below that line. A street would be far less blocked in by gables thus springing below and rising above a line of, say, 70 ft., than by a range of buildings all terminating with a monotonous horizontal line, 70 ft. above the street.

SOMERS CLARKE,

15, *Dean's-yard, Westminster, S.W.*
December 21, 1889.

FRENCH BUILDING TERMS IN MASONRY.

SIR,—I think the definitions of "pierre de taille" and "moëllon" given by you in your issue of December 14th last the correct ones, and in support of this will, with your permission, quote the following extracts from the "Devis et Cahier des charges" for the construction of "Etablissement de la distribution d'eau" of the town of Lille:—

Art. 65.—"Les parements vus de briques ou de moëllons seront établis légèrement en retraite sur ceux de la pierre to taille. . . . Les lits de rangées de briques et de moëllons réguliers seront établis en prolongement de ceux des chaines en pierre de taille, de telle sorte que plusieurs rangées correspondent toujours exactment sans entailles à une assise de pierre de taille, et se raccordent régulièrement avec elle."

Art. 64.—"On pourra exiger à volonté pour chaque espèce de taille que la surface du parement vu soit unie ou ciselée sur . . ."

And in the "Bordereau des prix" is the following item:—

"Le mètre cané de taille fine de pierre de Soignies ou de Maffles applicable aux parements vus, avec ou sans moulures."

Art. 51.—"Les moëllons bruts . . . seront . . . bien gisants, présenteront des arêtes et des angles vifs et devront cuber 8 décimètre cubes au moins . . ."

Art. 62.—"Les enrochements et blocages de fondation seront exécutés en moëllons de la plus forte dimension des canières d'——"

Art. 63.—". . . ces moëllons seront posés, suivant leur lit de canière, normalement aux surfaces à revêtir dans toute l'épaisseur de la maçonnerie, en menant de front le remplissage et le parement, de manière à former une bonne liaison entre eux."

From this it would appear that "pierre de taille" is the French equivalent for all masonry of large worked stones laid in even courses, whether ashlar, block facing, or moulded work; and "moëllon" that for rough walling in foundations, backing, or random facing.

The past participles "ebousiné*-e" and "dégauchi-e" are both used in the document quoted from as follows:—

"La pierre de taille blanche. . . . sera ébousinée à vif et. . . ."

"Les lits et les joints seront parfaitement dégauchis dans toute l'étendue des surfaces de contact."

FREDERIC ELIE GAY.

* "Ebouziné" is the spelling in the best French dictionaries.—ED.

THE LONDON COUNTY COUNCIL AND THE PURIFICATION OF THE THAMES.

Sir,—The action of the London County Council, as reported on page 446 of to-day's *Builder*, in regard to the purification of the Thames, is worthy of the highest commendation. The Metropolitan Board before it finally expired set up its own *memento mori* in the shape of a couple of "white elephants" for the Londoners to stable at Barking and Crossness, in the belief that the sanctity of the animals was so great that none would dare to do aught than reverence them. A second Alexander, however, has arisen who has quietly passed his sword through them both, and nothing now remains but to dispose of their carcases to the best advantage.

As this appears during the festive season, I beg to propose the health of the London County Council, coupled with the name of Councillor Æneas Smith. My reason for doing this is because the question of the purification of the Clyde has for a number of years back been troubling the minds of the citizens of Glasgow. The opinions of two of the most eminent engineers of the day were got as to the best solution of the problem; but, on the plea of expense, the community that aspires to the rank of the second city in the Empire has refused hitherto to rise to the situation, and for the last fourteen years has done nothing. Now, however, it is thinking of making a pretence of doing something. It is going to experiment! It will follow the admirable example of the Metropolitan Board,—at a respectful distance, of course,—and get a nice little white elephant of its own stabled at the east-end of the city; but how the discharge from this curiosity is to be anything better than pouring a teaspoonful of questionable water into a bottle of ink, I cannot conceive. This elephant is to cost about 40,000*l.* or 50,000*l.*, independent of food and attendance. It may be expected, however, that the action of the London County Council on the 17th inst. will cause the Council here to pause before committing itself too far.

Glasgow made a mistake already at its East-end, when it allowed the weir to be taken down. The setting up of chemical precipitation works there for a fifth part or so of the city sewage would be another mistake.

The pollution of the Clyde by chemicals and sewage effluent is not solving the problem of its purification. It would only be a piece of municipal jerry-work, and the Council condemns this sort of work when done by other people.

If Glasgow is not yet prepared to face Sir John Hawkshaw's scheme, carried out on the lines now proposed for London, and which are the same as what have been already advocated for Glasgow, it had better wait a few years longer, and then it will have saved up as much as will pay for the whole of it.

W. P. Buchan.

Glasgow, Dec. 21, 1889.

CHURCH BUILDING NEWS.

Ilminster.—On the 4th inst. St. Mary's Church was re-opened, after extensive alterations and improvements. The whole of the church has been re-floored, the vaults filled in and concreted, and new heating apparatus (supplied by Messrs. Collins & Co., Bristol) provided. It is intended to replace the old pews with open benches of oak. The work has been done by Mr. A. Poole, of Ilminster, under the supervision of the Diocesan Architect, Mr. J. D. Sedding. The cost of the alterations will be about 1,500*l.*

Kingston-on-Thames.—The new Church of St. Luke, of which the foundation-stone was laid in November, 1888, was consecrated by the Bishop of Rochester on the 14th inst. The style of architecture is Gothic, of the thirteenth century. The plan comprises nave, north and south aisles, the dimensions of which are 75 ft. 6 in. long by 57 ft. 6 in. wide; chancel, with apsidal termination, 30 ft. by 23 ft. 6 in., having organ-chamber, 12 ft. 6 in. by 12 ft. 6 in. on the north side, and chancel-aisle, 14 ft. 6 in. by 14 ft. 6 in. on the south side. Opening south of the chancel-aisle is a small vestry. This vestry will be a vestibule to a large choir-vestry and parish-room not yet completed. The height of the nave-roof is 60 ft., and the height of the chancel-roof 43 ft. The height of the tower and spire when completed will be 141 ft. In the tower, fixed temporarily, is a bell by Messrs. Warner & Co. The entrances are from a porch opening into the north aisle, and a western door opening into the centre of the nave. The nave arcading consists of five bays, having the arches in three orders, supported by quatrefoil shafts, with carved caps and moulded bases. The stone label terminations to nave arcading are carved, with heads. The chancel arch is supported by shafts with carved caps and moulded bases. Arches open from the organ-chamber into the chancel and north aisle, and from chancel aisle into chancel and south aisle. The arches are to be filled in with oak screens. The roof principals of the nave and chancel are supported by stone shafts, having moulded and carved corbels, bands, and bases. The stone corbels in chancel are carved with angels bearing emblems of the Passion. The roofs throughout are open-frame-timbered. The nave and aisles have framed principals. The chancel roof has moulded curved ribs, filled in between with diagonal boarding, and has a moulded embattled cornice. Five traceried windows light the chancel, lancet windows light the aisle and clearstory, and a large group of lancet windows light the nave from the west end. The porch and west doors have the orders supported by stone shafts with moulded and carved caps and bases; over the west doorway is a traceried panel having the emblem of St. Luke, with carved foliage. A low traceried stone screen divides the chancel from the nave. On the south side of chancel is a carved stone sedilia, and on the north side a carved stone credence niche. The altar-steps are of polished white veined marble. The moulded oak communion-rail is supported by wrought metal standards. The font, placed near the end of the north aisle, has a carved alabaster bowl supported by eight Devonshire marble shafts resting on a green marble base. The cover is of oak, and is to have ornamental wrought-iron scrollwork on it. The choir-seats and prayer-desks are of oak, with carved ends and traceried fronts. The nave seats are open deal benches, with traceried fronts. The doors are of oak, and have ornamental wrought-iron hinges and furniture. The church is built in brick, and faced throughout with selected red facing bricks, and moulded red string-courses, weatherings, and abaci, and with stone dressings. The roofs are covered with green slates, with red ridgings. The east and west ends, also porch and chancel aisle, have floriated stone crosses. The chancel has a wrought-iron floriated cross. The passages of aisles and nave are paved with wood blocks, laid herring-bone pattern, with straight borders. The chancel and porch are paved with Maw's red encaustic tiles. The organ has been constructed by Mr. C. H. Walker, Manchester-street, London. The architects are Messrs. Kelly & Birchall, of London. The contractor for the whole of the works was Mr. W. H. Gaze, of Union-street, Kingston-on-Thames. The contracts, without the tower and spire, amount to 5,139*l.* Messrs. Jones & Willis supplied the wrought-iron work, and executed the font from the designs of the architects. The heating has been carried out by Messrs. Green & Sons, Blackfriars-road, London; and the whole of the stone carving was executed by Mr. Millburn.

Reading.—On the 2nd inst. Her Royal Highness Princess Beatrice (Princess Henry of Battenberg) visited Reading to open a bazaar in aid of the funds for the restoration of the Church of the Holy Trinity, Reading. The bazaar realised 500*l.* The parish is very poor, and is one of the largest in the Diocese of Oxford, having a population of 7,000. The church was in a dangerous condition, and has recently been restored at a total cost of 1,900*l.*, by Messrs. Wheeler Bros., from the designs and under the superintendence of Mr. Geo. W. Webb, architect, Reading.

PROVINCIAL NEWS.

Jarrow-on-Tyne.—A large block of business premises has just been erected in Evison-street, Jarrow, for Messrs. Johnson & Armstrong, consisting of three shops, with show-room, work-room, and offices, &c., above. One of the shops has been specially designed and fitted-up for a butcher's shop, and lined with Minton's tiles and marble. The window sashes, of mahogany, are made to slide out of sight behind the fan-light of ornamental wrought-iron work and stained glass above. The bench is of marble upon a red granite base. Special over-head tramways are fitted up for moving meat to any part of the premises. The building, which is Renaissance in character, is of red bricks (Normandy), and Denwick-stone dressings. The whole of the work has been carried out under the superintendence of the architect, Mr. J. Walter Hanson, of South Shields; Mr. Hugh Shield being the clerk of works, and Messrs. Jas. Storar & Son, the contractors.

Rotherham.—At a recent meeting of the Rotherham Board of Guardians, the recommendation of the committee was unanimously approved with regard to the proposed enlargement of the Workhouse. The enlargement includes taking down the greater portion of the present buildings, and providing new Tramp and Receiving wards, Lunatic wards, Board and Relieving Officer's rooms, Master's house and offices; Able-bodied Blocks for men and women, with large day rooms, children's and nursery day and night rooms, baths, lavatories, &c.; new Dining Hall to accommodate 350; kitchens, and scullery fitted with complete steam cooking arrangement, bakery stores, &c., also laundry, wash-house, &c., with steam washing appliances. The works also include new foul wards and isolation hospital, and workshops, stables, wood-sheds, &c., with complete re-arrangement of the whole of the drainage. The estimated cost of the above scheme is 22,000*l.* Mr. H. L. Tacon, of Rotherham, architect to the Board, has prepared the whole of the plans and specifications, which have been approved by the Local Government Board.

STAINED GLASS.

London.—A stained-glass window has lately been placed in the chancel of St. John's Church, Deptford. The window is of two lights, and illustrates the subject of the presentation of Our Lord in the Temple. This is surmounted by canopy work in white and stain, according with the style of architecture of the church. The window was designed and executed by Messrs. Warrington & Co., of Fitzroy-square. ——The ceremony of unveiling the west window of Trinity Church, Tredegar-square, Stepney, recently took place. The window, which is of Perpendicular character, comprises three lights and traceries, and illustrates in eight subjects the Life of Christ. It is presented in memory of Mr. Peter Atrell, of Stepney, a constant worshipper at the church for many years, by several of his friends. The work has been designed and executed by Mr. F. W. Chowles, of Eversholt-street, Oakley-square.

East London (South Africa).—A large stained-glass window of three lights has been placed in the transept of St. Michael's Church, East London, South Africa, which is now being completed. The subject treated is "The Resurrection of the Dead," the centre light representing our Saviour in this aspect, and the side lights "Jarius's Daughter" and "The Widow's Son of Nain" respectively. A large side window has also been filled, the subject, which has been carried through two lights, being "Christ Blessing little Children." Both windows are erected to the memory of the late Mr. C. Bradfield Brown, a sidesman of the church, and are the gift of the parents of the deceased gentleman. Messrs. W. James & Co., Kentish Town, were the artists who executed the work.

Mayne, co. Westmeath.—Stained glass has lately been inserted by Messrs. Chas. Evans & Co. in the east window of Mayne Church, to the memory of two sisters, at the cost of the congregation.

Stourport.—The east window of the old parish church of Astley has recently been filled with subjects illustrating "Christ Instructing His Disciples," the parable of the "Good Samaritan," &c., with an elaborate brass at foot recording that the window is erected to perpetuate the memory of the Rev. Henry Minford Cookes, forty-six years rector of the parish. The ornamental portions are treated in character with the Norman period of architecture, and the whole has been designed and executed by Messrs. Charles Evans & Co., London.

New Premises in Cornhill.—A very interesting ceremony took place on Friday, the 13th inst., at 39-41, Cornhill, E.C., the occasion being the setting of one of the large granite bases supplied by Messrs. Whitehead & Sons, of Aberdeen, which forms part of the main entrance doorway for the new premises of the Union Discount Company of London, Limited. The stone was set by Mr. William Dunn, in the presence of his co-directors. Mr. J. Macvicar Anderson, the architect, was unavoidably absent. The contractors, Messrs. William Cubitt & Co., of 258, Gray's-inn-road, were represented by Mr. Benjamin Hannen. Mr. William Lumsden is the foreman of works.

The Student's Column.

WATER-SUPPLY. — XXVI.

WATER-RAISING (*concluded*).

UP to the present we have been considering the question of water-raising by means of power derived from the water, or the air as found in a natural state; but as has been pointed out it is only where circumstances and surroundings are favourable that these powers can be applied to pumping purposes.

The energy of heat is the only source of power used by man to any extent in those cases where natural power is not available, and without going into the problems connected with the science of thermo-dynamics, we may with advantage briefly consider its leading facts; for whether our prime mover be steam-engine, gas-engine, or hot-air-engine, its laws and principles apply equally, and in the same way to them all.

Heat is a state of being or a state of molecular mob agitation (Osborne Reynolds); it cannot be seen, and its properties can only be inferred from its effects, and, as we know of no substance not in a state of heat, its properties may more correctly be said to be inferred from experiments on different intensities of the same state.

Heat is empirically measured by a unit, which in England is the quantity of heat required to raise 1 lb. of water 1 deg. F.

The first and most important law of heat is—the evolution of heat is proportional to the mechanical energy expended. From some beautiful experiments Dr. Joule (in whose death this year we lose one of our greatest physicists) found that the mechanical equivalent of heat, or one thermal unit for the latitude of Manchester, equals 772·43 ft. lbs.

The second great law of heat deduced from the principles laid down in 1824 by Sadi Carnot is thus expressed by Mr William Anderson, M.I.C.E.* "That the proportion of work which can be obtained out of any substance working between two temperatures, depends entirely and solely upon the difference between the temperature at the beginning and end of the operation."

And the third great law is—that "Heat only flows down the gradient of temperature, and in any particular substance the rate at which heat flows is proportional to the gradient of temperature. Hence to get the heat from the source or furnace into the working substance a certain time must be consumed, and this time diminishes as the difference of temperature of the furnace and the working substance increases."†

When heat is transmitted from one substance to another the substance that receives heat expands, as is well known; the whole of the heat received by the substance is not expended in increasing the volume of the substance, but may be said to be divided into three portions. The first is employed in raising the temperature of the substance; the second part is occupied in increasing the amplitude of the molecular vibrations, and thus giving the substance increased volume; while the third portion of heat is employed in doing work,—that is, in lifting the atmosphere. All substances expand under heat,—solids least, then liquids, and gases most.

The first law of heat enables us to judge from our coal consumption whether our engine is doing its duty to the best advantage.

The second law tells us that the whole of our engine's efficiency lies in the difference between the temperature of the air in which it is working and the furnace, on the one side, and that of the air and the exhaust steam, or the water from the condenser, on the other side.

And the third great law tells us that the hotter the furnace the shorter the time required to produce a given volume of steam; hence forced draughts.

To do more than briefly indicate the chief points as above, however interesting the subject may be, would be going away from the main object of these articles; but to the engineer, who has to select a motor for continuous work such as water-pumping required, the points indicated are of the very greatest importance.

If we take an indicator diagram from a properly-designed pump, we shall find that we obtain practically a rectangle, thus proving that the pressure is uniform throughout its stroke, and it therefore follows from this that the very best engine for pumping purposes will be that one in which, by means of some device, the effect of the superfluous pressure of the steam on the piston in the first part of the stroke of expansion working is stored up to be given out later on, when the pressure in the cylinder is less, and by this means make the power uniform throughout the stroke.

The usual way in which this is effected is by means of a heavy fly-wheel, but as moving the weight of the wheel takes up a good deal of the power of the engine, a great many mechanical arrangements have been tried with varying success to dispense with this accessory; one of the best is that in which two small opposing hydraulic rams alternately resist and assist the piston.

Hot-air engines are largely used to drive pumps where a small water supply is desired; they require little skilled labour, are simple in their action, and, not having any boiler, are perfectly safe from explosions. Formerly, hot-air engine furnaces were inside the machine, and great wear and leakage was caused by particles of coal and grit rising with the heated air into the cylinder. There are now, however, several forms of this engine made in which the furnace is separated from the working parts. Hot-air engines are only used for small powers, from ¼ to 6-horse power, as larger sizes become unmanageable.

The gas-engine is another form of heat-engine, only in this, as our fuel is clean and free from grit, we can burn it inside the cylinder, and so get the full advantage to be derived from the heat. In this engine, more than in the hot-air engine, great strides have been made during the past few years towards perfection. In using gas-engines for pumping purposes, it is advisable to drive the pumps with reducing gearing.

It is probable from the indication given by recent practice, that in the future our pumping engines for supplying the largest towns and cities will be of the compound condensing duplex type, with compensating apparatus to enable the steam to be worked expansively, and automatically controlled by some form of governor or cataract which only allows the engine to travel at the same fixed rate under all sorts of varying conditions of pressure or load.

The ordinary duplex pump is an arrangement of two steam pumps side by side, the valves of the one pump being controlled by the piston of the other pump in such a way that there is no dead point. These pumps work very well, and as they pause at the end of the stroke allow the valves to seat themselves quietly and properly. Both the pumps being double-acting, the flow of water is practically continuous. Steam is admitted for almost the whole of the stroke, and to cushion the ends the exhaust is closed comparatively early. These pumps work best in connexion with shallow wells when they are not more than 25 ft. to 28 ft. from the water, but they can be made to force water to any height required.

The best pumps for large house wells are the old-fashioned lift and force-pumps, and plunger-pumps are better than piston-pumps, especially those in which the plungers are outside packed, and are easily accessible, for then any leakage can be immediately detected and the plunger-gland tightened. It frequently happens that pumps have to be placed in wells in which great difference in water-level takes place; in such cases, the usual plan is to place the working barrel of the pump a little above the lowest water-level, and on the top of this to place a stand-pipe sufficiently high to come above the highest water-level, and of a little larger diameter than the barrel. This forms a wet spear-pump, and the pump-bucket can be drawn up and re-packed or re-leathered whenever necessary.

Pumps should be arranged so as to make the delivery of water as constant and uniform as possible, and for this purpose two or even three barrels are frequently grouped together and worked from the same crank-shaft. It is also advisable to have an air vessel attached to the delivery end of the pump for low or moderate lifts, especially when single pumps are used, whether double acting or not; but in the case of excessive heights or very long lengths of pipes the air vessel is not of much use, and it is then better to have as long a stroke as possible. It is also a good thing to fix a vacuum vessel to the suction-pipe, particularly in those pumps that work at a quick speed, as this checks the impact of the water against and allows the suction valve to seat itself quietly.

In selecting pumps too much care cannot be taken in examining the arrangement and position of the delivery-pipe, to see that there are no spaces where air can collect, and also that the water has a free way or course right through, for it must be remembered that reversal of current and unnecessary bends do very much to increase the work and diminish the efficiency of a pump.

The best speed at which to run an engine is not always the best speed at which a pump works, and in almost all engines not specially made for and attached to pumps the piston speed is much too great, and in order to obtain the best effect must be geared down to such a speed that the pump has sufficient time to fill the barrel and seat its valves quietly; for the water can only pass through the valves and passages at a certain rate. This, of course, applies rather more to the suction than to the delivery, as in the suction end of a pump we have only the pressure of the atmosphere to force the water into the pump, and this being easily overcome a vacuum is made, which in the return stroke of the pump may have disastrous effects on the machinery. From this it will be seen that the diameter of the suction-pipe and valve in relation to the diameter of the plunger is a very important point, and should never be more than in the proportion of two to three; sometimes they are made of the same diameter: the suction-pipe should, as a rule, be larger than the delivery pipe.

In the machinery for water-supply to large towns some provision should be made for break-downs, either in pumps or engines; this is usually done by duplicating both, as in the Leatherhead waterworks. Duplication is not necessary for supplemental service in the case of those places whose water is derived from only moderate depth, as in such cases large centrifugal pumps, or pulsometers of very much less first-cost, can be used for temporary purposes, or in case of fire, or for other reasons when a greatly-increased supply is suddenly requisite.

* Anderson on "The Generation of Steam."
† Prof. Osborne Reynolds's "General Theory of Thermo-Dynamics."

VARIORUM.

"WHITAKER'S ALMANACK" FOR 1890.—Too late for notice last week with other almanacks, we have received this deservedly-popular annual. It is bulkier than ever, containing 728 pages as against 704 last year. Several new supplementary articles are given, and there is a list of the members and principal officers of the London County Council, which has been revised up to date, for Mr. Clement Dunscombe's name is recorded as Engineer, and that of Mr. Andrew Young as Valuer. The salary of the last-named gentleman is mentioned, but those of the Engineer and Mechanical Engineer are not stated, although the amounts were publicly mentioned in the Press (in our own columns and elsewhere) when the appointments were made. Perhaps the Editor wishes to intimate that the salaries in question are not quite what they should be, and are therefore not worthy of mention. The list of "Societies and Institutions" is not as complete as it might be, for neither the Institute of Journalists nor the Shorthand Society are included in it. Under the head of "Professional Education," the Editor might usefully, in future issues, give a little space to a brief mention of the examination schemes of the Royal Institute of British Architects and the Surveyors' Institution. Nearly all the usual summaries and statistics have been extended in the present issue, and we know of no more useful and carefully-compiled work of reference than "Whitaker's Almanack," which is edited by Mr. Joseph Whitaker, F.S.A., and published at 12, Warwick-lane, Paternoster-row.——"The City Diary" for 1890 (London: W. H. & L. Collingridge), is, as usual, full of information regarding the Corporation of London and City matters generally, but while it gives the names of members of the Corporation and of the School Board, it makes no mention whatever of the London County Council, — an omission which will detract from the usefulness of the diary.—— The "Leisure Hour" (London: 56, Paternoster-row) for December continues "The Story of the English Shires," by Canon Creighton. Derbyshire is the county treated of in this number, and illustrations of Haddon Hall and Bolsover Castle are given, together with views of some of the picturesque scenery of the Peak district. Mr. W. J. Gordon con-

tributes an illustrated article on "The Building of the Forth Bridge." The January number of the same magazine contains an article by Mr. Richard Heath on the French painter J. F. Millet, of whom a portrait is given, as well as an engraving of his picture "The Evening Angelus." —— The "Sunday at Home" for January, issued from the same office as the foregoing, publishes, by permission of Messrs. Doulton & Co., a representation of Mr. George Tinworth's terra-cotta panel of "The City of Refuge," which has been fixed, we learn, over the door of a chapel at Wraysbury, near Windsor.——"The Girl's Own Paper" and "The Boy's Own Paper" are two excellent magazines for youth, published at the same office. "The Girl's Own Paper" for January contains an article on "Celebrated Monuments of Eminent Women," illustrated by a full-page engraving, drawn by Mr. H. W. Brewer, showing three monuments in the south aisle of Westminster Abbey, viz., those of Margaret, Countess of Richmond; Mary, Queen of Scots; and Margaret Douglas, Countess of Lennox.——"Cassell's Magazine" for January (London: Cassell & Co.) contains a useful article, signed "E. Crossley," on "Gesso work," and one entitled "The Story of the Dwelling-house," by Edwin Goadby.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

895, Electrical Burglar Alarms. J. C. and G. Fuller.

To obviate the use of a spring, which rusts and decays, a falling weight or lever is, according to this invention, used instead. The pressure of the door or window lifts the lever and keeps the contacts apart, but as soon as the pressure is taken off, the lever falls and completes the circuit. The contact, suitable for either doors or windows, is not likely to get out of order, and can be fitted with an ordinary centre-bit by any common workman.

7,596, Ornamenting Columns, &c. J. A. Wilson.

According to this invention the pillars or columns are covered with glass, porcelain, or hollow tiling, either moulded or cast, or fixed on before the columns are put up, or put on afterwards in semi-circular sections, the inside of the glass being gilt or decorated, and the joints cemented or suitably fastened.

14,733, Waterproof Slabs, &c. D. Nicoll.

By this invention slabs or blocks are suspended one over another to correspond in tenon and mortise, allowing only sufficient space between them to extend over both surfaces, and when these are sufficiently heated, the upper slab is lowered and fused or jointed to the lower one, thus producing a block of great dimensions and strength. Several previous patents by the same inventor, having similar objects, are referred to.

14,899, Improvements in Water-closets. A. F. Morrison and M. Ingram.

In the closet which is the subject of this patent, a bent connecting-horn of any material is used in the pan or basin to deflect the water, and to be more easily attached to the supply and delivery-pipe.

14,493, Drain-testing Apparatus. B. Merriam.

This invention claims to provide a vessel permanently attached to a drain-pipe, which vessel receives a bottle containing an odorous liquid substance—oil of peppermint, for instance. The bottle is corked and placed upside down in the vessel, the cork resting on a pin or shaft. When the cover of the vessel is screwed down the cork is pierced and the liquid trickles out, and, by its odour, any leak or opening in the drain-pipe is detected.

13,807, Bolts, Fastenings, and Hinges. W. Cussans.

According to this invention, these fastenings are made with a hollow stem, in which slides a chilled or hardened steel pin, and it is surrounded with a number of chilled balls, so as to prevent the bolts from being cut through with a saw. A device is used to draw the sash-bars together, but the principal novelty is in the use of the hardened bolts and balls.

16,536, Tiles for Lining Walls, &c. H. Hall.

The tiles which are made in accordance with this invention are provided with lugs and rebates in dimensions which are multiples of each other, and so proportioned and arranged in relation to each other as to enable them to be fitted together either in straight lines or in broken lines, as may be desired.

NEW APPLICATIONS FOR PATENTS.

Dec 9.—19,744, G. Marsden, Tiles, Bricks, &c.—19,782, H. Cowan, Exit-door for Theatres, &c.—19,783, H. Cowan, Automatic Window-fastener.

Dec. 10.—19,814, G. Plunkett, Slow-combustion Ventilating Grate or Fireplace.—19,825, G. Verity and J. Thomas, Raising and Lowering Sliding Doors.—19,825, T. Prosser and W. Carter, Staining and Mottling Wood.—19,854, E. Jessurun, Screw-drivers.—19,872, J. Bredel and H. Zulauf, Closing Doors.—19,885, J. Miller, Door Locks or Latches.

Dec. 11.—19,963, R. Reeves, Ventilation, Warming, and Cooling Air.

Dec. 13.—20,097, C. Douglas and E. Smith, Saws. 20,107, W. A. Kerman, Kilns for Bricks, Lime, Cement, &c.

Dec. 14.—20,148, C. Thompson, Fire Grates or Stoves.

PROVISIONAL SPECIFICATIONS ACCEPTED.

14,702, J. Bradshaw, Chimney-pot or Top.—15,737, W. Timewell, Portland Cement from hard limestone. — 16,774, H. Maddern, Carpenter's Plough and Filister.—17,332, F. White, Door Check and Fastener.—17,953, F. Hilton, Weather-boards for Doors.—18,241, C. Callow and H. Eck, Removing Floor and other Fixed Boards.—18,242, J. Downs, Plates and Mouldings for Hearths, &c.—18,421, F. Lane, Marking Timber, &c.—18,449, A. Braid, Joining Plaster Slabs used for Lining Walls, &c.—18,455, A. Braid, Fire-resisting Plaster-linings for Walls, &c.—18,480, G. Buffham, Ventilators.—18,653, M. Carter, Decorating in Bas-relief.—18,658, F. Hollmann and P. Maruischke, Fireplaces. 18,883, G. Arnold, Firegrates, 19,015, N. Sorensen, Handles for Doors, &c.—19,292, A. Jones, Nail or Metallic Fastening.—19,302, R. Little, Mortising Chisel.—19,341, R. Pulton, Paint Cans.—19,343, G. Bischof, White-lead.—19,345, M. Slane, Hinges.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to Opposition for Two Months.

354, S. Fisher, Wall-hangings, &c.—355, F. Frier, Working Stone.—2,319, R. Livingston, Opening and Closing Casements, &c.—12,539, De Pennefather, Ventilating.—2,573, W. Punchard, Apparatus for Depositing Concrete.—4,220, W. Smith, Sewer and House-drain Traps.—17,531, G. Cheetham, Securing Windows in any Position.—17,799, A. Rammage, Construction or Build-up of Iron Bressummers and Girders.—17,961, J. Fell, Coating or Covering Exposed Wood Structures or Timbers.

RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

Dec. 16.—By Buckland & Sons.

Camberwell — F.g.r. of £35, with reversion in 73 yrs.	£735
F.g.r. of £18, with reversion in 78 yrs.	380

By Wood & Kirby.

Enfield—The reversion to eleven cottages, yielding £191. 11s. a year, life aged 81 yrs.	900

By A. Chancellor.—(At Richmond.)

Barnes—7, Stanley villas, u.t. 78 yrs., g.r. £3, 10s.	200

Dec. 17.—By Collier & Bowdich.

City.—20, Wormwood-street, Corporation Lease, g.r. £7. 18s., r. £280 p.a.	5,800
21 and 22, Wormwood-st., Corporation Lease, g.r. £10. 10s. 8d., r. £380 p.a.	7,420

By Messrs. Foster.

Pall Mall.—No. 26, F	17,800
Oxford-st.—No. 287, F, r. £500, p.a.	12,500

By C. & H. White.

Brixton. — 54, Akerman-rd., u.t. 25 yrs., g.r. £5. 5s. 6d.	240
Kennington.—5, Faunce-st., u.t. 75 yrs., g.r. £6	300

By Geo. Gouldsmith, Son, & Co.

Sydenham.—99, High-st., F, r. £40 p.a.	600
Lingfield, Surrey.—Tithe Rent Charge of £71 a year	800

By Driver & Co. (at Gray's).

Gray's, Essex.—"Rose Cottage," f., r. £15 p.a.	350
Thirteen plots of f. land	690
A plot of f. land, 1a. 3r. 1p., r. £3. 10s. p.a.	160

Dec 18.—By W. J. Palmer.

Southgate—The f. building known as the Congregational Church	585
The residence known as "Poplar Villa," f.	780

By Dunn & Soman.

Kensington-sq.—No. 3, and ten sets of stabling, f.	3,100

By Mullett, Booker, & Co.

Hyde-Pk.—20, Connaught-sq., u.t. 31¼ yrs., g.r. £20	1,720

By J. H. Hunter.

Paddington—I.g.r. of £138, u.t. 73 yrs., g.r. £4	2,690
I.g.r. of £119, u.t. 90 yrs., g.r. £2	2,430

By Jones & Son.

Mile-end—2 and 4, Redman's-rd., u.t. 20 yrs., g.r. £8, r. £52	310
Peckham—2, Rye-hill-pk., f.	395

Dec. 19.—By Rushworth & Stevens.

Portman-sq.—4, Gloucester-st., u.t. 33 yrs., g.r. £50, r. £150 p.a.	1,250

By Bean, Burnett, & Co.

Walthamstow—68 to 78, Granville-rd., u.t. 97 yrs., g.r. £31. 10s.	1,150

By R. Wood.

Finchley—1, Moss Hall-crescent, u.t. 77 yrs., g.r. £13	640

By R. J. Collier.

Bermondsey—F.g.r. of £20, with reversion in 60 yrs. to £102 p.a.	470
Battersea—F.g.r. of £12, with reversion in 80 yrs. to £33 p.a.	270
F.g.r. of £11, with reversion in 59½ yrs. to £38 p.a.	250
Kingsland—7 to 15, Louisa-st., u.t. 43 years, g.r. £56, 14s., r. £306. 16s. p.a.	£560
Bermondsey—11, 12, 15, 16, and 17, Brandon-st., u.t. 80 yrs., g.r. £31. 10s., r. £104	260

Dec. 20.—By Greatorex & Co.

Whitechapel-rd.—No. 15, f., area 2,130 ft.	975

[*Contractions used in this list.*—F.g.r. for freehold ground-rent; I.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; yd. for yard, &c.]

MEETINGS.

Tuesday, December 31.

Royal Institution.—Professor A. W. Rücker, M.A., F.R.S., on "Electricity" (adapted to a juvenile auditory). I. 3 p.m.

Wednesday, January 1, 1890.

Builders' Foremen and Clerks of Works' Institution.—Ordinary Meeting. 8.30 p.m.

Thursday, January 2.

Royal Institution.—Professor A. W. Rücker, M.A., F.R.S., on "Electricity" (adapted to a juvenile auditory). II. 3 p.m.

Friday, January 3.

Architectural Association.—Mr. S. B. Beale on "Spires, Towers, and Domes." 7.30 p.m.

Saturday, January 4.

Association of Public Sanitary Inspectors.—The Rev. Arthur Robins, M.A., on "Human Homes for the Poor, the Question of the Hour." 6 p.m.

Royal Institution.—Professor A. W. Rücker, M.A., F.R.S., on "Electricity" (adapted to a juvenile auditory, III. 3 p.m.

Miscellanea.

The Frankfort Waterworks.—During the last ten years the Corporation of the City of Frankfort has expended a large sum of money upon the improvement of its water-supply. Up to the year 1878 the water-supply was exceedingly bad and insufficient, the water being mostly drawn from wells, but in that year the waterworks at Vogelsberg and Spessart, situated in the mountains some fifty miles from the town, were completed, the cost being 502,000*l*. The water is obtained by the natural pressure from the sandstone and basalt rocks, that in the former aqueduct being 13·3, and the latter 12 atmospheres. These works are capable of supplying about 3,000,000 gallons of water per twenty-four hours. The water is passed through concrete aqueducts and iron mains to two iron reservoirs near the town, one being capable of holding 4,200,000 and the other 3,000,000 gallons. This is ample for the supply of the town for twenty-four hours. During the last few years, however, the number of inhabitants having increased from 100,000 to 150,000, this supply was found insufficient, particularly in the summer, and it was, therefore, first decided to enlarge the works at Spessart at a cost of 115,000*l*., but some borings having been effected in a wood some three miles from the town by the authorities, an excellent supply of water was obtained from a stratum of gravel and sand at a depth of from 30 ft. to 50 ft. In consequence it was decided to increase the supply from this source. The water is obtained through the medium of a number of copper tubes sunk to a depth of 40 ft. They are 2 in. in diameter, closed at the bottom, perforated, and bound with copper-wire to prevent sand entering, and through these the water percolates into a main running horizontally, whence it is pumped into a reservoir. It might be supposed that these small tubes would hardly yield the required supply; but they yield, in fact, as much as 800,000 gallons per twenty-four hours. The whole installation has cost 45,000*l*. A pumping-station has also been erected close to the Main, at a cost of 4,000*l*., whence river-water is pumped to the slaughter-houses, markets, fountains, sewers, &c. The continuous supply of the town now amounts to nearly 5,000,000 gallons of water per twenty-four hours. As an example of the benefit derived from these water improvements may be mentioned that the mortality from typhoid and kindred diseases in the town has fallen from 8 per 10,000 inhabitants in 1870 to 1·1 at present.

The Institute of Patent Agents.—The first qualifying examination for certificates entitling to admission to the Register of Patent Agents, established under the Act of 1888, was held Nov. 18 to 23, by the Institute of Patent Agents, under the regulations passed by the Institute and approved by the Board of Trade, in accordance with the Register of Patent Agents Rules, 1889. The successful candidates were:—Mr. Thomas Henry Barron, of Huddersfield, and Mr. George Beloe Ellis, of London.

The late Mr. F. R. Conder.—We briefly mentioned last week the death of Mr. F. R. Conder, M. Inst. C.E., which occurred suddenly at his residence in Guildford on the 18th inst. According to the *Surrey Advertiser* he rose early on the date in question in little less than his usual good health, and died while reading in his study about half-past ten. The deceased, who was a member of the Institution of Civil Engineers, was just over 74 years of age. He was the eldest son of Mr. Josiah Conder, who was well known in his day as a literary man, and as one of the early Committeemen of the Anti-Slavery Society. In his youth Mr. F. R. Conder made a fortune, which, however, was lost by the repudiation of responsibility by the Italian Government after Garibaldi's revolution. Starting again with the indomitable courage which was one of his many great qualities, he became an authority in his profession and an honoured contributor to the highest class of English literature. Many years of his life were spent in perfecting his "Iron Process" for the deodorisation of sewage. Personally, Mr. Conder was a lovable man. In Guildford, where he had lived about fifteen years, his loss will be deeply mourned, and much sympathy will be felt for the widow and family in their painful bereavement. Mr. Conder leaves two sons and a daughter, the eldest being Major Claude R. Conder, the Palestine explorer. The funeral took place on Monday at the cemetery.

Clowne and Barlborough Sewerage.—A special meeting of the Worksop Rural Sanitary Authority was held a few days ago at Worksop, to consider the plans prepared by Mr. W. H. Radford, C.E., Nottingham, for the sewerage and sewage disposal of Clowne and Barlborough. Mr. Radford was present, and explained that he proposed to lay down two systems of pipe-sewers and deliver the sewage at two separate outfalls. There would be one outfall for each parish, and about half-an-acre of land would be required for the purification works at each outfall. The sewage would be purified in tanks by means of chemical precipitation combined with filtration through special filter-beds. The chemical system adopted would be that known as the "Acton process," as applied at Hendon; and no machinery or pumping would be required, as the chemicals would be suspended in a wire basket, and dissolved by the flow of the sewage. Several ratepayers attended from Clowne to represent that some of the proposed sewers for draining Harlesthorpe, High Peak, and Laburnum-terrace were not at present required, as there was only a scattered population of about 700. The further consideration of the schemes was adjourned.

Trade Catalogues.—From Messrs. Archibald Smith & Stevens we have received their new catalogue of self-sustaining lifts and hoists, which embody many improvements, and appear to fully justify the use of the compound adjective "self-sustaining." The catalogue is well worth looking at by architects having to consider the question of the provision of lifts for passengers or goods. The dinner-lifts are also deserving of attention.——Messrs. Morrison, Ingram, & Co., of Cornbook, Manchester, have sent us their catalogue of baths, lavatories, and other sanitary appliances. They are very numerous, and mostly very good of their kind, and the catalogue will be found useful for reference. Nevertheless, we must once more protest against the placing of water-closet apparatus, of no matter how good a type, in bath-rooms, as is proposed in two bath-room suites,—one for "the mansion" and one for "the villa,"—which are shown in all the glory of polychromatic printing, but which will rarely or never be placed in rooms of the airy spaciousness which the draughtsman has imagined. For obvious reasons the "arrangement" in question cannot be too strongly deprecated.

East of Scotland Engineering Association.—At the third meeting of the session, held on the 17th inst. in Edinburgh, Mr. James Thomson, C.E., vice-president, in the chair, Mr. Archibald C. Elliot, D.Sc., C.E., read a paper on "The Design of Masonry Dams." The lecturer proceeded to explain a new method which he had devised for calculating the sectional area of masonry dams, and compared it with the methods in use for designing such structures. The lecture was illustrated by large diagrams of the Vyrnwy, the most important in this country, and other masonry dams. Dr. Elliott was cordially thanked for his paper.

Torquay Water Supply.—At the last meeting of the Torquay Local Board, Mr. T. S. Weeks, superintendent of the waterworks, reported that the third section of the duplicate main, from Jew's-bridge to Knowles-hill, a distance of 5,600 yards, had been completed. The increase to the delivery at Chapel-hill was at the rate of 155 gallons per minute, or 223,200 gallons per day; at Warberry reservoir the increase was 87 gallons per minute, or 125,280 gallons per day. Calculating for twelve hours' delivery into each reservoir, the available additional daily supply would be 174,240 gallons, or rather more than four gallons per head for the 43,000 persons supplied from these works. The works had cost, including landlords' and tenants' compensation, 5,795*l.*, being 475*l.* less than the estimate. Of this, 374*l.* was on the iron pipes, the tender being 7*s.* 6*d.* per ton under the estimate. The chairman congratulated the Board on the manner in which the work had been carried out, and general satisfaction was expressed at the way in which Mr. Weeks had performed his task.

The Panama Canal.—A Swedish engineer, Herr C. Rahm, who for some years has been employed on the Panama Canal works, and who has just returned to Europe, states that half of the canal must now be considered finished, viz., 18 kilomètres from the Caribbean Sea, and 15 kilomètres from the Pacific Ocean, whilst in the intervening space the works have made good progress. The locks have been excavated to three-fourth parts of their size. Herr Rahm estimates that the whole canal might be finished in four years if the work is prosecuted with vigour. Six Swedish engineers have been employed upon the works. The negroes are considered the best workmen.

"The Wilmington Giant."—The *Standard* says that the restoration of the remarkable figure known as the Wilmington Giant is now being taken in hand by the Sussex Archæological Society, and is being actively prosecuted. Investigation shows that bricks were used for its preservation more than a hundred years ago, but, at the request of the Rev. W. A. St. John Dearsley, the Committee of the Society have consented to allow him to experiment with rammed chalk. The Wilmington Giant is situated on the estate of the Duke of Devonshire.

New Harbours in Russia.—The Russian Government has under consideration proposals for the construction of two new harbours in the Arctic Ocean, viz:—a naval one on the so-called "Fish Peninsula," near the Norwegian frontier, and a commercial one in the Bay of Petschengi. It is also contemplated to extend the railway from St. Petersburg to the White Sea.

India-rubber Paving.—The inventor of the india-rubber paving now being tried in Berlin, Hamburg, and Hanover, and recently referred to in these columns, is Herr Busse, engineer, of Linden by Hanover.

PRICES CURRENT OF MATERIALS.

TIMBER.	£.	s.	d.	£.	s.	d.
Greenheart, B.G. ....ton	7	0	0	7	15	0
Teak, E.I. ....load	12	0	0	14	0	0
Sequoia, U.S. ....foot cube	0	2	2	0	3	0
Ash, Canada ....load	3	0	0	4	5	0
Birch ,, ...load	3	0	0	4	15	0
Elm ,, ...load	3	10	0	4	15	0
Fir, Dantzic, &c. ....load	2	0	0	3	10	0
Oak ,, ...load	2	10	0	4	10	0
Canada ....load	5	10	0	7	0	0
Pine, Canada red ....load	2	10	0	3	10	0
,, yellow ....load	3	0	0	5	5	0
Lath, Dantzic ....fathom	4	10	0	5	10	0
St. Petersburg ....fathom	5	0	0	6	10	0
Wainscot, Riga, &c. ....log	0	0	0	0	0	0
Deals, Finland, 2nd and 1st ....std. 100	8	10	0	11	0	0
,, ,, 4th and 3rd ....std.	7	0	0	8	0	0
Riga ....std.	7	0	0	9	0	0
St. Petersburg, 1st yellow ....std.	11	0	0	14	0	0
,, 2nd ,, ...std.	9	0	0	10	10	0
,, white ....std.	6	10	0	10	0	0
Swedish ....std.	7	10	0	10	0	0
White Sea ....std.	9	0	0	17	0	0
Canada, Pine, 1st ....std.	16	0	0	20	0	0
,, ,, 2nd ....std.	11	0	0	17	10	0
,, ,, 3rd, &c. ....std.	8	0	0	10	10	0
,, Spruce, 1st ....std.	9	0	0	11	0	0
,, ,, 3rd and 2nd ....std.	7	0	0	9	0	0
New Brunswick, &c. ....std.	6	0	0	8	10	0
Battens, all kinds ....std.	6	0	0	17	0	0
Flooring Boards, sq., 1 in., prepared, First ....sq.	0	11	0	0	14	0
Second ....sq.	0	8	0	0	10	0
Other qualities ....sq.	0	6	0	0	7	0
Cedar, Cuba ....foot	0	0	4	0	0	5
Honduras, &c. ....foot	0	0	4	0	0	4½
Mahogany, Cuba ....foot	0	0	5	0	0	6½
St. Domingo, cargo average ....foot	0	0	5	0	0	6½
Mexican, cargo average ....foot	0	0	5½	0	0	6½
Tobasco ,, ...foot	0	0	5½	0	0	6½
Honduras ,, ...foot	0	0	5½	0	0	6½
Box, Turkey ....ton	4	0	0	13	0	0
Rose, Rio ....ton	15	0	0	20	0	0
Bahia ....ton	14	0	0	15	0	0
Satin, St. Domingo ....foot	0	0	0	0	1	3
Porto Rico ....foot	0	0	10	0	1	6
Walnut, Italian ....foot	0	0	4½	0	0	6½
METALS.						
IRON—Bar, Welsh, in London ....ton	7	15	0	8	5	0
,, ,, at works in Wales ....ton	7	5	0	7	15	0
,, Staffordshire, in London ....ton	8	10	0	9	10	0
COPPER—						
British, cake and ingot ....ton	55	0	0	56	0	0
Best selected ....ton	57	0	0	58	0	0
Sheets, strong ....ton	66	0	0	67	0	0
Chili, bars ....ton	49	0	0	0	0	0
YELLOW METAL ....lb.	0	0	5½	0	0	6
LEAD—Pig, Spanish ....ton	14	2	6	0	0	0
English, com. brands ....ton	14	2	6	0	0	0
Sheet, English ....ton	16	5	0	16	10	0
TIN—Banca ....ton	100	0	0	0	0	0
Billiton ....ton	99	0	0	0	0	0
Straits ....ton	98	5	0	0	0	0
Australian ....ton	97	10	0	0	0	0
English Ingots ....ton	102	0	0	0	0	0
Bars ....ton	103	0	0	0	0	0
Refined ....ton	104	0	0	0	0	0
OILS.						
Linseed ....ton	20	10	0	20	15	0
Cocoanut, Cochin ....ton	26	10	0	0	0	0
Ceylon ....ton	23	10	0	23	15	0
Palm, Lagos ....ton	25	10	0	0	0	0
Rapeseed, English pale ....ton	34	0	0	0	0	0
,, brown ....ton	32	10	0	0	0	0
Cottonseed, refined ....ton	21	15	0	0	0	0
Tallow and Oleine ....ton	21	0	0	40	0	0
Lubricating, U.S. ....gal.	0	10	0	0	10	0
,, refined ....gal.	0	0	0	0	0	0
TAR—Stockholm ....barrel	1	6	0	0	0	0
Archangel ....barrel	0	15	6	0	15	0

COMPETITIONS, CONTRACTS, & PUBLIC APPOINTMENTS.

Epitome of Advertisements in this Number.

COMPETITIONS.

Nature of Work.	By whom Required.	Premium.	Designs to be delivered.	Page
Designs for Galleries or Balconies, Town-hall	Leeds Corporation	50*l.* and 25*l.*	Jan. 31st	ii.
New Baths, Winter Gardens, &c.	Harrogate Corporation	150*l.* 100*l.* 75*l.* & 50*l.*	Mar. 1st	ii.

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
Wesleyan Chapel, Hastings	The Trustees	E. Hoole	Dec. 30th	xii.
Making-up Road	Ealing Local Board	C. Jones	Jan. 2nd	xii.
Roof and Interior Work, Wood Block Floor	Newington Reform Club	Banister Fletcher	do.	xii.
Sewerage Works	Barnet R. S. A.	— Mansbridge	Jan. 8th	ii.
Removal of Dust, &c. (one year) Regent's-pk	Crown Estate Paving Commissioners	*Official*	do.	ii.
Breeze, Ashes, and Dusting (one year)	St. Marylebone Vestry	do.	Jan. 9th	ii.
Carting Away Slop and Sweeping (one year)	do.	do.	do.	ii.
Road and Street Watering	do.	do.	do.	ii.
Public Conveniences, Wrt-iron Fencing, &c.	London County Council	do.	Jan. 11th	xii.
Macadam Spalls	Brighton Town Council	F. J. C. May	Jan. 16th	ii.
Making-up Roads	Wood Green Local Bd.	*Official*	Jan. 24th	xii.
Works and Materials (one year)	Liverpool Corporation	do.	Not stated.	xii.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.	Page.
Chief Surveyor of Main roads	Stafford C. C.	800*l.*	Jan. 8th	xvi.

TENDERS.

[Communications for insertion under this heading must reach us *not later than* 12 *noon on Thursdays.*]

BROMLEY (Kent).—For new billiard-room, stabling, &c., at the "Two Brewers" Hotel, Bromley, for Messrs. Nalder & Collyer's Brewery Company, Limited. Mr. R. M. Chart, Surveyor, Mitcham:—

T. Crossley, Bromley	£1,520 0 0
G. H. Lay, Bromley	1,354 0 0
Satchell, Bromley	1,309 0 0

BIRMINGHAM.—Tenders for hot-water warming apparatus and hot-water supply at Selly Oak Workhouse, near Birmingham, for the King's Norton Union. Henry Lea & Thornbery, Birmingham, engineers:—

Summerscales & Sons, Keighley	£5,180 14 6
Thomas & Taylor, Stockport	3,834 6 0
W. W. Phipson, London	3,729 2 6
W. Jenkins & Son, Leamington	3,549 0 0
G. H. Knott, Dewsbury	3,511 7 0
J. Jackson, Birmingham and Newcastle	2,763 2 0
Hassall & Singleton, Birmingham	2,481 6 0
T. Parkes, Birmingham (accepted)	2,283 1 0
Eagle Iron and Engineering Co., Coventry	1,976 12 6

DAWLISH (Devon).—For building Masonic Hall, Dawlish, for the Masonic Lodge Company. Mr. Geo. Soudon Bridgman, architect, of Torquay and Paignton:—

Shapter, Dawlish	£898 0 0
Lamacraft, Dawlish	725 0 0
Friend, Dawlish	690 0 0
Westcott, Dawlish	617 0 0
W. Hatcher, Dawlish (accepted)	614 0 0

HAMPTON.—For the erection of a boat-shed and workshop on the river front of Maybury Lodge, Thames-street, Hampton, for Mr. Chas. Constable. Mr. Walter J. Ebbetts, architect, 115, Strand, W.C.:—

W. Steel	£545 0 0
Wright	515 0 0
Harmer	513 0 0
Wheatley & Son	489 0 0
Sabey & Son (accepted)	479 0 0

HARROGATE.—For stables, &c., Grove House, Harrogate, for Mr. Samson Fox, C.E. Mr. T. Butler Wilson, architect, Harrogate:—

Wm. Irwin & Co., Leeds	£5,499 0 0
Moulson & Son, Bradford	5,440 0 0
Gould & Stephenson, Leeds	5,243 6 9
Walter Binns, Bradford	5,036 7 8
Ives & Son, Shipley	4,929 0 0
Chas. Myers, Leeds	4,912 0 0
David Simpson, Harrogate	4,900 0 0
Wm. Nicholson & Son, Leeds	4,888 15 0
James Simpson, Harrogate	4,842 3 7
Thos. Linskill, Harrogate (accepted)	4,830 0 0
Rainforth & Hudson,* Harrogate (withdrawn)	4,674 0 0

* Declined to agree to complete by May 1.

LONDON.—For alterations and repairs to No. 18, Gosfield-street, Marylebone, for Mr. Betteridge. Mr. Alfred J. Hopkins, architect, 27, Mortimer-street, W. Quantities supplied:—

Derry	£534 0 0
Cooper	520 0 0
Mattock Brothers	509 0 0
Burningham & Co.	490 0 0
Bywaters	475 0 0
Perkins	444 0 0
Banks	416 0 0
Rhodes	412 0 0

LONDON.—For repairs, &c., to Nos. 2 and 3, Whittaker-street, Pimlico, S.W., for Mrs. Berrell. Mr. Walter J. Ebbetts, architect, 115, Strand, W.C.:—

H. Baylis	£117 10 0
W. D. Way	109 0 0
W. Steel (accepted)	99 0 0

LONDON.—For alterations and shop-fittings at No. 17, Davies-street, W., for Messrs. Cooper & Co. Mr. William A. Burr, architect, 65, Chancery-lane, W.C.:—

Larke & Son	£484 0 0
Langham	477 0 0
Stevens Bros.*	453 0 0

* Amended and accepted at £444. 15s. 6d.

LONDON.—For alterations to the "Birdcage" public-house, Birdcage-walk, S. Mr. Christopher M. Shiner, architect:—

Clark	£489 0 0
Potter	477 0 0

MICHELMERSH (Hants).—For new boiler-house and setting boiler, at the South Hants Water Company's pumping works at Michelmersh, Hampshire. Mr. W. H. Mitchell, architect, Southampton:—

W. H. Chapman, Woolston	£439 0 0
H. Stevens & Co., Southampton	422 0 0
G. Wheeler, jun., & Son, Romsey	374 18 0
T. J. Jukes, Southampton (accepted)	370 0 0

PAIGNTON (Devon).—For building a Public Hall, Palace-avenue, Paignton, for Public Hall Company. Mr. Geo. Soudon Bridgman, and Mr. W. G. Couldrey, architects, Paignton. Ten Tenders were originally sent in from quantities supplied by Mr. S. G. Goss, architect, of Finsbury, London, the lowest of which was £2,121, but in consequence of extensions to the site, the plans were somewhat altered, and the four lowest were asked to compete again. Result:—

H. Weber, Paignton	£2,464 10 0
M. Bridgman, Paignton	2,469 7 0
E. Bovey, Torquay	2,449 0 0
R. Yeo, Torquay	2,435 0 0

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TO CORRESPONDENTS.

A. E. M. (your report only to hand on Friday, after we had published last week's number. We had anticipated you).—"Invicta." (write to the Secretary, 74a, Margaret-street, Cavendish-square, London).—E. B. M.—F. B.

All statements of facts, lists of tenders, &c. must be accompanied by the name and address of the sender, not necessarily for publication.

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